Rock Products

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A Model Large Tonnage Plant

Ward Plant at Oxford, Mich., Uses 16-In. Pumps in a Relay System to Produce 100 to 150 Cars Daily With Novel Methods of Material Handling and Screening

By J. K. Costello

THE Ward Sand and Gravel Co.'s plant at Oxford, Mich., is probably the largest single unit producing washed sand and gravel in the United States. The qualifying adjective is necessary because in such a progressive industry new plants are constantly being built and old plants are being enlarged for greater production. And there are several plants in the country which have a very large potential capacity. But at the moment the writer knows of no other plant that is loading from 100 to 150 cars a day as a regular thing, and that has such a tremendous material handling capacity that it can load 20 cars in 30 minutes, which this plant has done more than once.

Unusual Problems Solved

But mere size, or tonnage, is not enough to make a plant especially noteworthy. There must be unusual features which show that engineering problems have been solved in the manner best adapted to the local conditions. We find plenty of these in the Ward plant. There is first of all the employment of 16-in. pumps. These are not considered large in harbor dredging, where the only work to be done is to shift the ground from one point to another, but they are very large pumps for the work of excavating sand and gravel to wash and load on to cars. Then there is the duplication of the pumping units, to save the time ordinarily lost in repairs; unusual in sand and gravel work, but most excellent engineering practice. And then there are the unique methods of handling the suction, of screening without loss of headroom and other interesting features which will appear in the plant description.

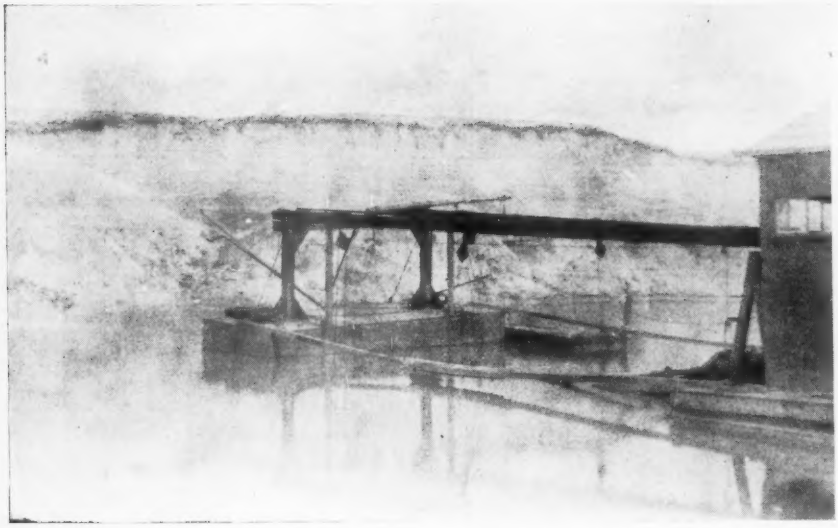
The main screen, at left, with the house for the relay pumps and line to sand flume

At a Sand and Gravel Center

Naturally, such a plant could not exist if there were not a market of almost unlimited capacity to absorb sand and gravel to receive its output. And such a market exists in the industrial region of Michigan in which the plant is situated, and where the growth in new industries, population and building has been so tremendous in the past decade. Oxford is, in fact, the center for a sand and gravel business which has risen to the status of a great industry. There are three other plants at Oxford which are numbered among the largest producers in the United States, and a number of others are scattered through the surrounding district. The existence of such a market justifies the building of such a large plant for, as one of the best known producers in the business puts it, "the sand and gravel game is a big one, and, a market being available, a large scale plant will develop greater profits in proportion than a small one."

The deposit of sand and gravel at Oxford, in which the Ward and the other

General view of shore plant, Ward Sand and Gravel Company



An unusual way of supporting a suction pipe. The pulleys are hung from a steel bridge, the outboard end of which rests on a pontoon

plants are working, is of a type common to the Northern states. It is a broad, flat basin into which glacial drift has been carried by successive yearly flows. This has deposited the material in strata of various depths. Naturally some clay has also been deposited and more has resulted from the disintegration of the material in place. In no part of the deposit, however, the clay in sufficient abundance to render washing difficult.

New Method of Digging

Excavation is accomplished by a method rather new in the sand and gravel industry. It employs primarily a 16-in. centrifugal pump, but it also employs a low pressure stream directed against that portion of the bank which is *above* the water to wash the material to the suction. This is not exactly hydraulicking in the usual sense of the word, since the force of the water is not sufficient to undercut the bank. The stream against the bank merely furnishes water to carry the caved material to the suction pipe.

The dredge mounts two complete 16-in. pump dredging units. Each unit consists of a suction, equipped with a Morris suction nozzle and a 16-in. Morris dredging pump protected by a stone box and driven by a 400-hp. electric motor. A 6-in. Morris centrifugal pump driven by a 100-hp. motor furnishes water for bearings, priming the pump and also the water stream that erodes the bank; and a Thomas hoist, driven by a 15-hp. motor handles the suction pipe. The suction pipes are not handled by the hoist through the ordinary boom or A frame arrangement. Instead of these, a steel bridge is used, the outboard end resting on a pontoon. Such an arrangement would not be practical in river dredging, where a current must be allowed for, but for dredging in a pond it is perhaps as satisfactory a method of handling a heavy suction pipe as could be devised.

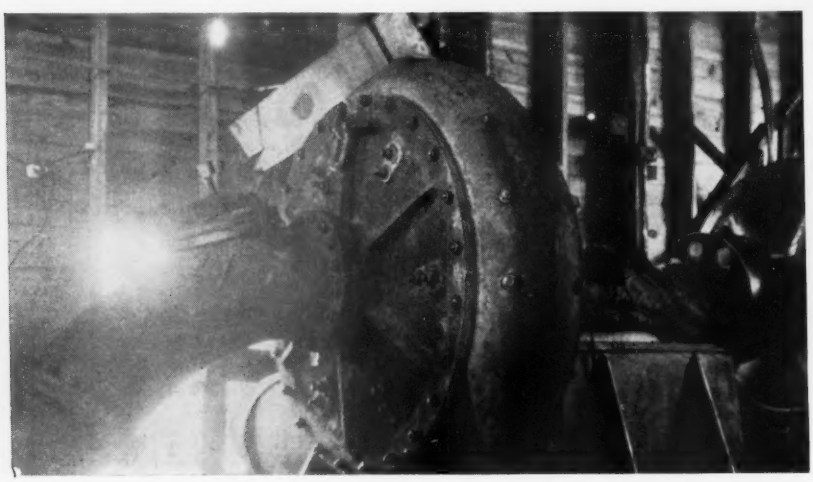
Another novel feature of the dredge is a covered barge attached to the rear of the dredge containing the starting resistances for the large motors. The controls, however, are on the front of the hull which holds the pumps. There is a complete workroom and parts room for spare pump runners and casings on the hull which carries the resistances.

One Pump Always Ready

Only one of the pump units is operated at a time, the other being held in reserve to be put in operation in case of necessary repairs or replacements, which can be done in a very short time.

The dredge excavates to a depth of about 20 ft. It is held in position by lines extending to deadmen on the shore and its position is changed by pulling and slackening these lines.

The shore end of the discharge pipe enters a box where the force of the discharge is broken before it flows over the main screen shown above



Suction end of one of the big 16-in. pumps on the dredge. This unit is duplicated, avoiding delays for repairs

A pipe line leads from each pump along each side of the dredge and the barge to the rear so that, when pumps are to be changed, either discharge may be hooked in on the main pipe line which is carried on pontoons to the shore. The main pipe line consists for the most part of American Rolling Mill's special analysis steel dredge pipe formed from very light section plate with a dentated weld. Joints in the pipe line are made with rubber sleeves with the usual clamps.

Main Gravity Screen

The pipe line conveys the material to the main gravity washing screen located above the pond near the shore. The dredged material passes through a "bubble box" to break its force and then on to the main screen.

This screen, which is about 20 ft. above the water level, is built with a fall of 1 in. to the foot. It is about 10 ft. wide and 30 ft. long. At the present time the first 20 ft. is narrowed to a 5-ft. width. Perforated metal round hole plates, arranged in four steps, each with a 2-in. drop, separate all the material under ¼ in. At the end of the narrowed portion of the screen metal baffle plates are erected to throw the stream over on to the broader part of the screen, as shown in the sketch.

The larger material which passes over the main screen impinges against curved metal plates that deflect the material in a even flow over a grizzly built of rectangular section bars spaced 2 in. apart and set at a 45 deg. angle.

The gravel which passes through this screen falls to a 32-in. conveyor belt. Oversize is delivered to a No. 7A Acme jaw crusher which discharges the reduced material to the same belt conveyor that handles the undersize.

As there are few flat stones in the material, this jaw crusher, equipped with corrugated crushing faces, is adequate. The crusher is located on appropriate foundations on the bank at the ground level. It is belt-driven by a 15-hp. motor located away from the water in a separate shed to the rear.

The ingenious method of making one belt conveyor serve a series of screens without loss of headroom

All material over ¼ in., or "stone," as it is called at this plant, is transported underground beneath the railroad tracks and up a slight incline and delivered to another belt conveyor at right angles which carries it up an 18 deg. incline to a trestle.

Here it is transferred to another belt conveyor that carries it out the trestle, where it is separated into the several sizes by two Mitchell screens.

Unique Screening Method

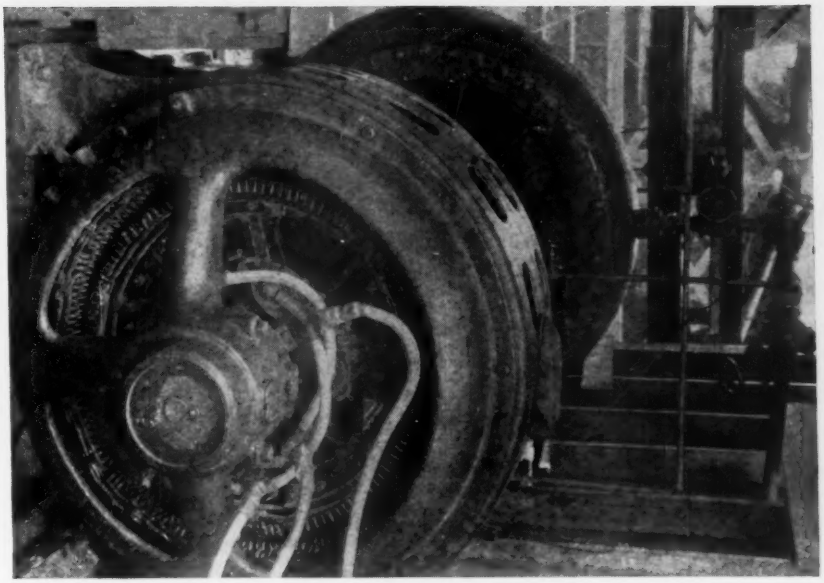
The method of passing the material through these screens is most unusual, if it is not unique, and it is well worth adopting in the flow sheet of many plants, since it enables a number of screens to be used in series without loss of headroom. The ordinary way is to bring the material to the first screen and then allow it to fall by gravity to the second and so on through the series. Thus there is a loss of several feet for each screen. But in the Ward plant the conveyor that brings it to the first screen passes it on to the second and could pass it to others, if there were a need of more separations.

Each Mitchell is protected by wire cloth of slightly larger mesh than that of the screen, which reduces wear and prevents the meshes from being covered with coarse oversize.

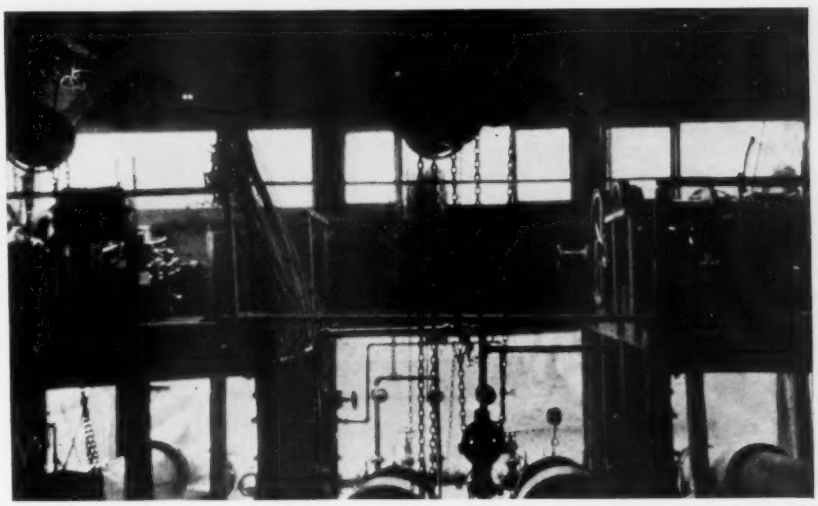
This coarse material is removed from the belt by means of a plow which is edged with a strip of rubber belting. The use of a plow for clearing a belt is not ordinarily considered good practice, as there is always danger that pieces will catch under it and be held so that they will wear the belt excessively. But in this case the pieces to be handled are all coarse, and the plow can be set so that it does not touch the belt and yet so that no piece will catch under it, thus removing the danger of undue wear.

The "stone" falls on a stock pile which is built up over a storage tunnel. In such a big plant as this the storage of material in piles instead of bins is almost essential, as bins of such large capacity as would be needed would be very expensive to build and would make the plant too costly. So the only bin used is really a loading hopper of large dimensions.

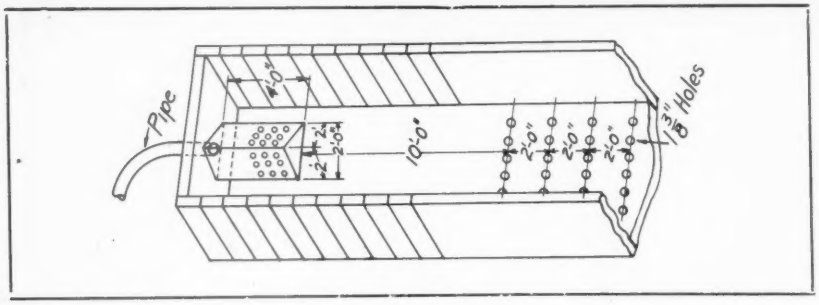
The advantage of using a storage pile



A 16-in. relay pump with 400-hp. motor. The relay pumping units are in duplicate the same as those on the dredge. All four pumps are driven by motors of the same size and type



Looking forward on the dredge. The hoists are shown on the upper deck. The 6-in. priming pump is below in the center and the two 16-in. dredge pumps at the sides



The pipe entering the sand flame passes into a triangular prism of perforated plates to scrub the sand and break the force of the flow. (Not to scale)

over a belt conveyor in a tunnel does not appear with small installations, where a bin will serve for both storage and loading. But with very large bins conveyors must be installed to fill the bins, because the width is too great to permit them to be filled by gravity alone.

The tunnel under the storage pile houses a 30-in. belt conveyor which receives the material through bin gates and carries it up an incline to the bin located above the railroad tracks.

At the end of this conveyor is a washing arrangement that is worth noting. A flat stream of water is made to flow from a box and on to the head of the belt so as to wash off the material and give it an additional rinse.

Returning now to the primary separation, made at the main washing screen which receives the pump discharge, it will be remembered that all the material less than ¼-in., called "sand" here, falls through the screen into a pool.

Use of Relay Pumps

At this point there are two 16-in. Amsco centrifugal pumps of the ordinary dredge type used as relay pump units. Each is driven by a 400-hp. electric motor. A two-drum Thomas hoist, driven by a 10-hp. motor, handles both suction pipes.

One of these relay pumps delivers the material that cannot be handled in current plant operation (or for which there is no immediate market) to a storage pile from which it is intended to reclaim the material by a clamshell bucket during the winter months.

The other relay pump elevates the material to a sand flume which acts as a classifier as well as a sand recovery device. The pipe conveying the stream to the sand flume discharges into a triangular prism, 5x2x2x2-ft., built of perforated metal round hole plates bolted together and open at the end. As the stream of water and suspended sand is discharged into the flume through this device it is broken up, agitated and the material given an added scouring to remove the clay. The top of the flume is covered over where this device is located to prevent material from splashing out of the flume. One of the sketches shows the start of the sand flume with the cover removed.

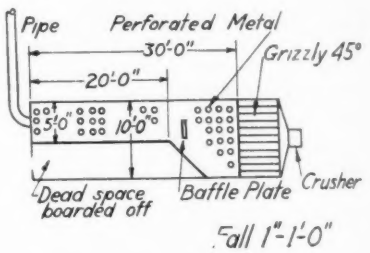
This flume is about 120 ft. long and 4 ft. wide. The bottom is pierced with 1⅜-in. holes bored in the wood bottom, in rows of four, 2 ft. apart longitudinally and beginning about 10 ft. from the feed end. The surplus water with the clay and some fine sand is drawn off at the end of the flume and chuted back to the pond.

The coarsest grains of sand are deposited in the part of the flume nearest the inlet, the settled sand becoming finer as the distance from the inlet increases. By setting the plugs right, almost any grade of sand can be made, according to the market and the purpose for which the sand is intended. For plants which have to handle a large tonnage, this is a very practical settler and classifier, although it would require too much attention if it were used to settle a small tonnage and a variable feed.

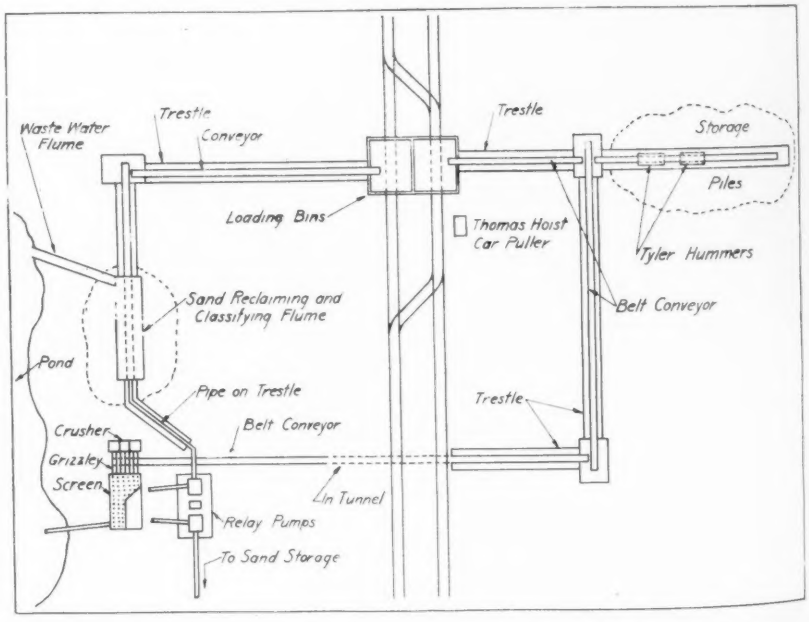
Storage piles are located below the sand flume. Beneath these storage piles a tunnel houses a 24-in. belt conveyor which receives the material through bin gates, transports it up a slight incline and transfers it to another belt conveyor which carries it up to the loading bin.

The two bins are built over the railroad tracks. Each bin can accommodate 5 cars at a time loading through 12 segmental type bin gates. There is a gate between the bins by which material can be mixed according to the judgment of the operator to make a "concrete mix."

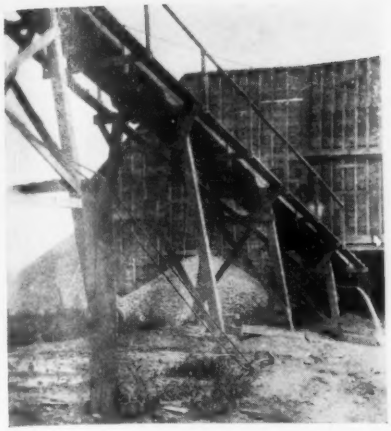
The plant is located on a double track spur extending a considerable distance beyond it. A railroad switch engine delivers the cars to the track beyond the plant. Cars are spotted on the hump beneath the bins by a Thomas hoist used as a car puller. When loaded the incoming car kicks the loaded car down the track where it awaits removal to the freight classification yards. Crossovers on both sides of the plant facilitate the routing of cars.



The main gravity washing screen has been narrowed down for part of its length and baffles put in to break the flow



Rough sketch (not to scale) showing layout of the short plant and tracks



Belt conveyor coming out of tunnel under stone storage pile

The plant can regularly load a car every two minutes.

The plant is operated by electrical power purchased from the Detroit Edison Co. Each unit is driven by individual electric motors. Power is received at the plant at 4400 volts and is transformed to 2200 and 220 volts for operating motors. All electrical power equipment at this plant is General Electric Co.'s make.

Timber Construction

The bins are of heavy frame wood construction. All trestles are sturdily built of large timbers with a walkway along each side of the belt to facilitate greasing

The loading bin is served with conveyors from sand and stone storage. A double track with crossovers permits rapid handling of cars

idlers and making repairs. Tunnels are lined with timber, except the stone tunnel of concrete. Owing to the topography of the ground, the tunnel under the stone storage piles has to be drained by a small centrifugal pump, while the other tunnel is drained by gravity. The plant is well illuminated for night operation. Searchlights, placed at the top, illuminate all conveyors the length of the belt.

The company is fortunate in obtaining exceptionally high grade American labor. Men are occupied mostly in watching and operating machines except for those on repair work, as the operation of the plant is practically automatic. The plant employs 56 men, divided into two 12-hr. shifts, although the men are paid for 13-hr.

This is the first season the plant has been in operation and experience has indicated no serious flaws in the design. Slight changes, such as lowering the level of the relay pumps near water level, are being accomplished.

The Ward Sand and Gravel Co. has its main offices in Detroit. Mr. F. L. Ward is president and general manager. Mr. John Johnson is plant superintendent.

While Mr. Ward designed the plant, he states that its success is due to Raymond W. Dull, consulting engineer, of Chicago, who designed the previous Ward plants and who passed upon or suggested all the features of the present plant except the dewatering arrangements.

The investment per ton of daily production is exceedingly low, as well as the operating cost, and the whole design shows that every detail was carefully thought out before construction was begun.

Concrete Railway Ties in India

THE North Western Railway of India has made exhaustive tests of a new type of concrete railway tie patented by a Delhi consulting engineer. Experiments have been made on 50 miles of main line track near Delhi, and the results have been so satisfactory that further 70 miles of track will be similarly equipped as soon as the necessary ties are manufactured, says a report to the Department of Commerce from Vice-Consul Robert F. Kelley at Calcutta. The tie consists of two concrete blocks joined together by a tie bar, the rails being fastened by means of a screw or dog spike driven into wood plugs, specially treated and compressed, set in the bed of the concrete block.

The other Indian railways are interested in concrete ties. The East Indian railway has been using a large number of Green-Moore patent reinforced concrete ties for seven years and has now nearly completed a factory for manufacturing 500,000 railway ties per annum. The Green-Moore tie is the invention of the deputy chief engineer of the East Indian railway and is similar in construction to the type in use on the North Western railway. They have been favorably reported on by the senior government inspector of railways since 1915-16, who states that they are still in perfect condition and show no signs of weakness. The Bengal Napur railway has decided to adopt the Green-Moore tie and has acquired a license to manufacture 300,000.—*New York Times.*

Explosive Accidents Relatively Low

INVESTIGATIONS conducted by the Department of the Interior through the Bureau of Mines relative to the hazards involved in the handling of explosive materials indicate that the number of accidents in handling and testing explosives is relatively low—in fact, it is lower than in some supposedly less dangerous occupations. Workers who handle explosives, being aware of the danger, practice carefulness until it becomes a habit; in consequence, accidents are relatively few. Accidents from explosives, however, receive more publicity than do most industrial accidents.

Any feeling of nervousness by a man engaged in handling explosives is highly dangerous, as it may result in his dropping a batch of sensitive material or knocking over a piece of apparatus. Men subject to nervousness should overcome it or get out of the industry. All explosives should be treated with proper respect, but it is not necessary to feel that the slightest jar will be disastrous.

The Bureau of Mines estimates that at least 75 per cent of all the industrial accidents with explosives are caused by hurrying the work and by taking chances where conditions are known to be dangerous; probably 20 per cent are due to carelessness, the rest having at least fairly excusable causes.

The great essential in avoiding accidents is that inexperienced men should be made fully conscious of every movement in handling explosives and should be trained to "play safe" until they are automatically careful all the time. Nearly all men become accustomed to working with explosives and feel no nervous strain, although after a bad explosion only a person of unimaginative temperament can work without excessive nerve fatigue.

In the laboratory a chemist naturally avoids spattering or spilling materials on his clothes or skin, or inhaling the fumes or fine particles of any explosive. Benzine, toluene, aniline, and their nitro compounds, besides other compounds, are known to be poisonous, but so is hydrogen sulphide, which all chemists use.

When preparing samples of explosives many analysts wear rubber gloves, but the usual course is to see that the hands are dry, to avoid direct contact as much as possible, and to wash the hands as soon as the sampling is finished. When possible, it is best to bathe the hands in a dilute solution of sodium sulphite, which acts as a solvent and is not readily absorbed by the skin.

When a sample contains, or is likely to contain, hexanitrodiphenylamine, special precautions should be used, as comparatively small quantities of it cause blisters and burns on the skin, and dust from it causes severe injury to the mucous membranes of the eyes, nose and throat.

Plaster From Ground Limestone

III—Colloid Chemistry Explains Some of Nature's Processes in the Manufacture of Limestone

By Cyrus Field Willard
San Diego, Calif.

WE went back in a former paper to the causes of the deposition of limestone as calcium carbonate sediments when the negative ion, the bivalent carbonate radical of sodium carbonate, borne in the river water, came in contact with the positive bivalent calcium ion existing in the ocean waters as calcium chloride and the union of the two bivalent positive and negative ions as calcium carbonate, while the two univalent ions united as sodium chloride.

The sodium chloride (common salt) has also at times been deposited in great beds and as rock salt, but this is a matter which it is not necessary to go into now, save to call attention to the many cases, as in Ohio, where the two are deposited not far apart.

This deposition of calcium carbonate occurred frequently at the mouths of the then rivers, where the fresh water of the river, bearing its load of chemicals washed from the rocks (and sodium carbonate is very soluble), came in contact with the alkaline waters of the ocean, as we see occurring at the mouth of the Mississippi today where the waters of the river are depositing its load and carrying the land out into the waters of the Gulf.

There were vast beds of fine calcium carbonate sediment deposited, which in some manner were turned from fine sediment, or mud, into crystalline and compact limestone, as we see in that great belt stretching from Quebec down through Vermont, eastern New York, Pennsylvania, Maryland and Virginia down South as far as Alabama. It used to be fashionable to attribute this change to the internal heat of "the molten interior" and to pressure which turned the fine sediment to rock, but it is probable that there are other factors which have a stronger influence.

One of these factors in colloid chemistry is termed coalescence. We are all familiar with the sight of two small raindrops on the window pane running together to form a larger drop, but we have yet to realize that finely divided solids will act the same in many respects when given the opportunity.

If a china plate is broken in two pieces, it is the film of air on the edges which prevents the two parts from cohering as they would in a perfect vacuum, because the air acts as an elastic cushion. This adsorption of an air film does not occur in the water, when the calcium carbonate is formed and then deposited by sedimentation, and thus the particles tend to coalesce with one another.

Cyrus Field Willard, San Diego, Calif.

EDITOR'S NOTE

SEVERAL weeks of most interesting and enlightening correspondence and a knowledge of some of his history, together with my own researches into the literature of colloid chemistry, have convinced me that the work of Cyrus Field Willard holds out some revolutionary possibilities to the rock products industry.

As this issue of Rock Products reaches its readers the editor will be speeding on his way to San Diego to see for himself just what Mr. Willard is doing; and Mr. Willard has already promised to make a slab of limestone plaster, under the editor's own eyes, to be exhibited at the next annual convention of the National Crushed Stone Association.—N. C. R.

When copper is precipitated electrically on copper in an electrolyte, the successive layers of copper coalesce to a uniform mass and the mass does not differ materially from copper which is cast with the same size of crystals. If care is not taken with nickel when electroplating we get an oxide film which prevents successful deposition of nickel. It is well known that an adsorption of oxide films prevent metallic surfaces from coming into intimate contact, and that it is necessary to have clean surfaces, even by using acids, when soldering and brazing.

All of us, no doubt, have had experience with the sticking together of two sheets of glass so we have had difficulty in separating them, while freshly split leaves of mica can be made to coalesce by simply pressing them together in the fingers. After they have been exposed to the air for five or ten minutes, it is impossible to make them unite again, as a coating of moisture, air or grease forms on them.

In the case of putty, which is whiting (ground limestone) ($CaCO_3$) with oil, we see a solid coated with a liquid film. On the other hand, when a finely powdered solid is added to a liquid the fluidity is decreased and the viscosity increased. Some determinations on the viscosity of lime paste were made by Emley (Transactions American Ceramic Society, 1913), where the viscosity would reach its maximum or its fluidity reach zero, when there was about 50 per cent of lime in the paste. The concentration producing zero fluidity seems to depend on the volumes of the voids, for we reach zero fluidity when enough liquid is added to fill the voids.

The word "adsorption" is different from the familiar "absorption," for it is used to denote the action which takes place, for example, when gases, like air or vapors, are adsorbed or condensed on the surface of the solid. As gases, vapors and liquids are adsorbed or condensed on the surface of the solid, so likewise are solids adsorbed by the solids under certain conditions.

Limestone Is Coalesced Calcium Carbonate

We have now come to the point where, after quoting liberally from the general theory, we see the sediment of precipitated calcium carbonate, in some cases thousands of feet thick, with the voids in the lower strata being gradually eliminated by being deprived of their adsorbed liquid and possibly gas films, and the particles being brought closer together by the superincumbent pressure of thousands of tons weight and certain collifying influences due to certain elements which were carried down when the sedimentation occurred, and which made in time a solid rock-like material which grew harder as time went on and the limestone was finally upheaved out of water and dried thoroughly.

When it is desired to weld platinum, it is only necessary to put two clean pieces of platinum together, in contact, heat them to a moderate temperature, far below the melting point of platinum and strike them a slight tap with a hammer and the job is done.

There seems to be no question but what a slight earthquake would produce the same effect with limestone. The saline solution being a good electrolyte, and frictional electricity being always produced by such "earth-slips" and the heat being sufficient to raise the temperature up to at least 100 deg. C., the boiling point of water, that temperature would be sufficient to make with the liquid in the voids a pasty mass of the limestone sediment; and when the heat was gradually withdrawn, it would leave the calcium carbonate sediment as a consolidated mass composed possibly of aggregated calcite crystals and forming what is called marble, for the heat must not have been enough to drive off the carbon dioxide and turn it into lime or calcium oxide.

(To be continued)

Old Theories of Marble Formation Are Changing

English Research Work of Great Significance to the Rock Products Industry Shows Marble May Be Made in Laboratory Synthetically

EXPERIMENTS and studies of much significance to the rock products industries have been, and are being made continuously, by chemists and research men in what are called the *pure sciences.* One branch of such science is geology, and that part of geology which relates to the origin and chemistry of rocks and minerals. Geologists pursue their studies to increase their knowledge and the literature of science and seldom, see any commercial significance in their discoveries, yet some of these discoveries hold some revolutionary possibilties to the rock products industries, as the series of articles by Cyrus Field Willard proves.

An example of geological research for the sake of science are the experiments of two British geological chemists to determine the origin of marble, briefly referred to in Rock Products July 28, page 26. These experiments were described in a recent issue of the *Journal of the Chemical Society* from which the following extracts are taken:

"In view of the facts that (a) saline media and carbon dioxide represent solvents for calcium carbonate (limestone), (b) pressure conditions crystallization, and (c) high temperature facilitates the formation of massive material, it was thought that a concentration of all three conditions would result in the formation of a marble. This expectation was subsequently fully substantiated.

"Two methods of formation of marble were evolved, both of which although quite distinct from one another, yet incorporate all the conditions set forth above.

"The first method, a direct process of formation of marble by double decomposition, may be characterized as that of chemical synthesis; the second, an indirect process, is perhaps the nearest approach to the metamorphic formation of marble (in nature) or marmarosis.

First Method

"Powdered anhydrous calcium chloride and hydrated sodium carbonate were packed in two layers, the latter substance forming the top layer, in an autoclave, heated in an oil bath. The internal temperature was raised to 300 deg. C. in the course of 2 hr. and kept at 300 to 305 deg. for 8 hr., the pressure rising to 24 atmospheres (350 lb. per sq. in. approximately).

"The autoclave was allowed to cool. The top layer, a saturated solution of sodium chloride (common salt) and some unchanged material or calcium carbonate, was poured off. The bottom layer was found to be a compact, stone-like solid. This was broken up into fairly large pieces, well washed with cold water and allowed to drain and dry.

"This product was found to resemble the purest natural marble; saccharoidal in structure, its fracture surface had a sparkling appearance, owing to the refraction of light by the crystalline facets, revealed by the cleavage. Although non-porous the product occasionally exhibited small cavities when examined in cross-section. The substance acquired a magnificent polished surface when cut, filed and rubbed on sand and emery papers, and finished off on rotating oiled cloth and velvet pads.

"Similar products were obtained by employing hydrated calcium chloride and anhydrous sodium carbonate, or by using both salts in the hydrated condition—the order of the layers being preserved. On reversing the order of packing or using an intimate mixture of the salts, the product was found to be somewhat porous.

"Marble of good quality was obtained when sodium bicarbonate was used in place of sodium carbonate. In this case, hydrated calcium chloride was employed, and the pressure in the autoclave released on cooling to 100 deg. C. on carrying out the experiment at 205 to 210 deg., the product was found to be of smaller cohesion.

Second Method

"Precipitated chalk was mixed with a saturated solution of sodium chloride to form an easily stirrable paste, in an open autoclave. The mixture was saturated with carbon dioxide at room temperature, the autoclave was then sealed and heated in an oil bath. The internal temperature was raised to 300 deg. C. in the course of 2 hr., —the pressure reaching 27 atmospheres (about 400 lb. per sq. in.). After 8 hr. heating at 300 to 305 deg., the autoclave was allowed to cool. The product was found to be identical in every respect with that described above. When finely powdered limestone was used, the marble obtained showed a coloration due to the impurities contained in the starting materials."

The older theory of the formation of marble is that limestone was changed into marble by tremendous temperatures and pressure caused by volcanic eruptions or other convulsions of nature. The experiments quoted show that under the right conditions comparatively moderate temperatures and pressures are all that may be necessary.

Nature, Preparation and Use of Pulverized Coal*

VII — Describing the Raymond Roller Mill and the Fuller-Lehigh Pulverizer Mill

By Richard K. Meade
Chemical and Industrial Engineer, Baltimore, Md.

THE Raymond roller mill consists of three parts—the mill proper, an exhauster and a collector. (Figs. 13 and 14.) The pulverizing unit of the Raymond mill consists of from two to six rolls which are freely suspended from a spider, which is in turn rigidly attached to a central vertical shaft. This shaft is driven by means of a set of bevel gears from below. When the central shaft is revolved, the rolls are swung outward by centrifugal force against a steel ring and, as they are free to turn, they roll around inside this ring. A plow is located ahead of each roll which throws a stream of material between the face of the roll and the ring.

The air enters the pulverizer through a series of tangential openings located around the base of the grinding chamber and directly under the ring and rolls. That portion of material which has been reduced to a certain degree of fineness is carried up by the air current into the cone-shaped chamber above the ring. Owing to the decreased velocity of the air current here, the coarse particles fall back and are thrown up by the plows to be reground between the ring and rolls, while the fully pulverized material is carried out by the air current. This air current is induced by means of an exhauster or fan.

The finely ground material is blown into a cyclone collector. This latter consists merely of a large cone-shaped chamber in which the velocity of the air is greatly decreased and consequently the particles of fully ground material fall to the bottom of this. The exhaust from the collector is returned to the mill through the tangential openings mentioned. An auxiliary collector is usually provided which serves an an air relief to the large collector. This is similar to the latter in all respects except that it is smaller.

These mills are subject to very nice regulation as to the fineness of the product. There are no screens in which holes are likely to wear and in consequence they give a product of uniform fineness. The Raymond mill also has the advantage that no elevator is required to convey this material into an overhead bin, as the collectors can be set sufficiently high to allow these to discharge directly into a bin or into a screw conveyor leading to the bin, etc.

The cost of repairs at the present time will average about 2 to 3 cents per ton of coal ground. The capacity and horsepower required to operate vary with conditions, such as the hardness of the coal, amount of moisture it contains, fineness desired, etc. Table X gives average figures when grinding dry coal to a fineness of 95 per cent passing the 100-mesh screen.

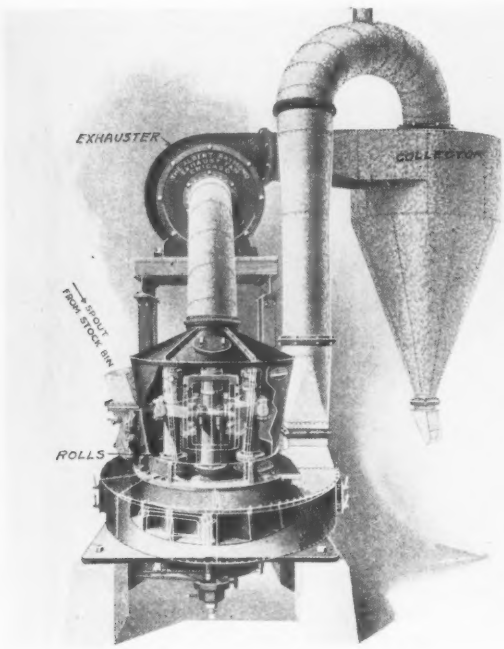


Fig. 13—The Raymond mill

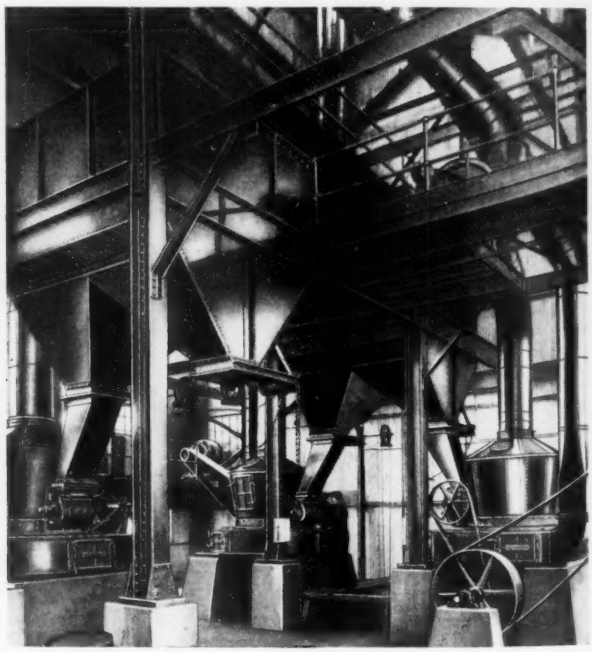


Fig. 14—The Raymond mills pulverizing coal

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TABLE X. AVERAGE CAPACITY AND POWER REQUIREMENTS OF RAYMOND ROLLER MILLS GRINDING BITUMINOUS COAL

Size mill	Capacity in tons per hr.	Hp. to operate
2-roller	2	40
3-roller	3	55
4-roller	4	75
5-roller	5	85
6-roller	6¼	105

The Fuller-Lehigh Pulverizer Mill

The Fuller-Lehigh mill is made in both screen and air separator types, both of which have for their grinding elements a horizontal cancave ring against the inside of which revolve four balls. These balls

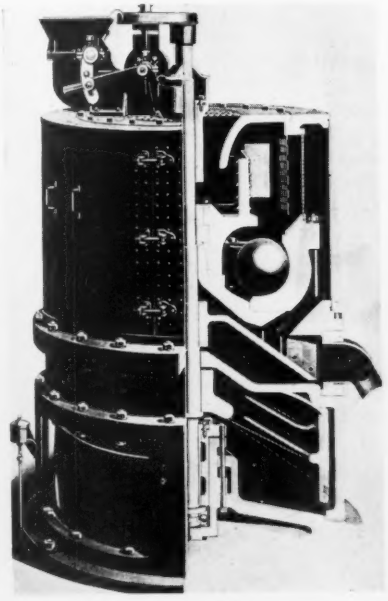


Fig. 15—Fuller-Lehigh screen type coal pulverizer

are propelled by four pushers attached to four equidistant arms radiating from a vertical central shaft. The coal to be pulverized is fed to the mill from an overhead bin by means of a worm mounted on top of the mill. This feeder is driven direct from the mill shaft by means of a belt running on a pair of pulleys. An eccentric and link motion permits the operator to regulate the amount of material entering the mill. In addition, the feed hopper is provided with a slide so that the rate of flow of coal from the bin to the feeder can also be controlled.

The coal is discharged by the feeder into the pulverizing zone of the mill and falls between the balls and the grinding ring, in a uniform continuous stream, and is so reduced to a fine powder.

The screen type mill, Fig. 15, is provided with two fans, one of which operates in what is known as the separating chamber or that portion above the balls and ring. The other fan operates in a housing immediately below the ring. The upper fan lifts the particles of pulverized coal from the grinding surfaces into the separating chamber where these particles are held in suspension. The separating chamber is surrounded with two screens, one an inner screen of heavy perforated sheet steel and the other an outer screen of wire cloth. The finely pulverized coal is sucked out of the separating chamber by the lower fan and passes through the screens and down into the lower fan housing, from which it is discharged through a spout. The screens do not actually screen the coal but serve to control the flow of air and so regulate the fineness.

Table XI gives the power required to operate and capacity when grinding dry bituminous coal of average hardness to a fineness of 95 per cent passing the 100-mesh screen, as stated by the maker.

TABLE XI. AVERAGE CAPACITY AND POWER REQUIREMENTS OF FULLER MILLS GRINDING BITUMINOUS COAL

Size mill—inches	Size feed—inches	Output in tons per hr.	Hp. to operate
24	¾	0.5 to 0.6	10
33	¾	2 to 2.5	30 to 35
42	1	4 to 5	50 to 70
[illegible]	1¼	5 to 6	70 to 85
57	1¼	8 to 10	95 to 110

Where the Fuller mill is driven from a

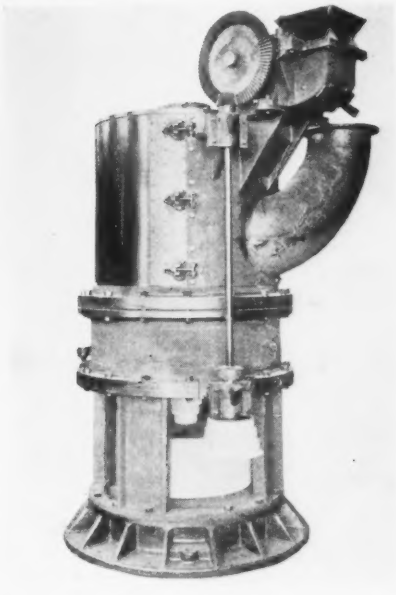


Fig. 16—Fuller-Lehigh air separating pulverizer

lineshaft it is usual to employ an idler and quarter-turned belt. When motor driven, a vertical motor is generally used; when gear driven, a horizontal motor.

The air separating mill, Fig. 16, is fitted with two fans. One of these fans with inclined blades operates in the fan housing immediately above the pulverizing zone, lifting the coarse and fine material from the top of the grinding element. The second fan is mounted above the mill on a separate support. This fan can be driven by belt direct from the pinion shaft of the mill as shown, or by motor drive. This fan causes an exhaust suction from the separating chamber with the least frictional resistance to the passage of air to the exhauster, which discharges vertically or angularly to a cyclone or collecting medium, which separates the fine product from the air for discharge into bins or conveyors serving any portion of the installation.

Most of the exhaust air from the separator is again returned to the pulverizer mill, where it again takes up the finished product from the separating section. The pulverizing medium is the same as described earlier in this article. The grinding ring, balls and pushers are the only parts subjected to the grinding action of the material being pulverized. All these parts are made of special mixtures having high abrasive resisting qualities.

This type of air separating mill is made in several sizes, the smallest of which has a 24-in. diameter grinding ring and the largest a 57-in. diameter grinding ring. The output from these mills ranges from 1600 lb. per hour to 12 tons per hour, fineness of product 95 per cent through 100 and 82 to 85 per cent through 200-mesh standard testing sieves.

In some installations, engineers prefer the screen type mill, while in other installations they prefer the air separating type mill. Both types of mills are highly efficient, take up small floor space, and cost less to install than most of the other pulverizer mills.

(To be continued)

Uses for Pulverized Limestone

IN the progress of a study of methods of utilization of waste rock at lime plant quarries being conducted by the Bureau of Mines it has been found that limestone pulverized to a much finer grained form than for agricultural use is finding wide application in various products.

Small quantities may be added to stock food as a bone builder.

A dust approximately 80 per cent of which will pass a 200-mesh screen is the most widely used filler in road asphalt surface mixtures, though slate flour and portland cement and hydrated lime are used to some extent.

Ground limestone is used to a limited extent as a fertilizer filler. It has the advantage over inert fillers in that it has valuable properties as a soil conditioner.

Very finely pulverized limestone may be used successfully as a whiting substitute in certain classes of rubber paint and other products. It is essential for such uses that it be very finely ground and uniformly sized so as to exclude all comparatively large-sized grains.

In general a limestone flour that will successfully meet the requirements of fillers of a type like whiting or china clay should approximate 300-mesh size. Few lime plant quarries have the equipment for grinding or sizing to this degree of fineness and have, therefore, been unable to utilize this promising field of application.—*Stone Trades Journal* (England).

Early Days in the Gravel Game

Personal Recollections of the Days When the Gravel Business Was Either Comedy or Tragedy, and How It Grew to Its Present Status

By F. W. Renwick
Chicago Gravel Co.

IT is undoubtedly an admission of old age, either in calendar years or actual service, when one can view the retrospective with the same amount of interest that he does the prospective, yet this is nearly or quite the case with the writer.

The early, pioneering days of the gravel business in this particular locality might be a comedy or tragedy, according to the viewpoint. I have only to recall the first gravel plant I was ever interested in to be moved either to laughter or tears. Perhaps it would be more accurate if I said profanity instead of tears. The reason in a way is obvious under fair analysis.

In World's Fair Year

Strangely enough the inspiration to attempt the well-nigh impossible started from an experience as a contractor in the very earliest days of what is now known as "good roads construction." An intimate friend with unusual vision in this good roads project, but with an equally unusual amount of impracticability inveigled me into several contracts for gravel macadam streets and highways in World's Fair year, 1893. At the termination of two years of rather unsucessful operation we agreed that the principal cause of our trouble was inadequate service and supply of material; and with a view of invading a field of apparently no competition, aside from the crushed stone people, we built our first plant in 1896 with an ordinary millwright and a fair machinist acting as designing engineers. Aside from our evident lack of business judgment in this method of procedure there was a real reason for this, namely, there was no competent engineer in this section of the country with whom to consult in reference to the erection of a gravel plant. The few equipment concerns who were then building crushing and screening machinery very charitably offered "the services of their engineering force" in designing a plant whereby their equipment would be utilized; but these plans when furnished were nothing more nor less than the installation of some fairly successful limestone plant, the principle of which has since been demonstrated to be exactly reversed from that of the average modern gravel plant. Consequently, it was a case of cut-and-try by novices who did not know exactly what they were trying to celebrate.

The first plant, as before intimated, was a genuine nightmare, both from a construction and operating standpoint. In this peculiar assembling of equipment, however, we did take the initial step for crushing of gravel by installing a No. 5 crusher,

A pioneer in the industry whose companies now produce 4,000,000 tons a year

the first machine of this size to operate continuously for this purpose in the Middle West. There had been in use two or three toy-size breakers, but all of them discontinued because, as one of the older members of the profession told me, "gravel could not be crushed on account of its hardness, and that it would cut out the heads and liners of the crusher in so short a time as to render the process impracticable."

City Would Not Use Gravel

At that time gravel for concrete was not permitted in specifications in the city of Chicago, and the entire marketable product of a gravel pit consisted of torpedo sand, a small amount of roofing gravel, which was used only in the spring and fall, and a size of material not in excess of 1 in., which was used as "ramming gravel" in the construction of the old-time cedar block pavement. As a result every alleged gravel plant within shipping distance of Chicago had piled up a mountain of the finest grade of material imaginable, running in size from three-quarters of an inch to the largest boulders found in the pit.

The First Steam Shovel

The following year we installed the first steam shovel used for digging material to feed a plant, and again we were criticised by our competitors as being just as impractical and extravagant in equipment installation as we were when we put in the crusher. Subsequent events have demonstrated that our guess was a good one, as a large majority of the present successfully operated plants are using both the steam shovel and from 1 to 10 crushers.

The graduation of a contractor to the gravel business in order to provide material for the former was not limited to this company as several others (notably W. P. Carmichael of the Carmichael Gravel Co., who was originally, and still is, a prominent contractor for concrete construction) had their first idea of embarking in the gravel business from the necessity of providing themselves with suitable material.

Another handicap the early gravel man had to contend with was transportation. In those days every railroad official was practically a czar in his own department, and one had to pass through several high-collared clerks in order to ask the traffic manager to please quote him a rate for the movement of perhaps 500 cars of material; and then frequently be informed that they were conferring a favor in even naming a rate "on this low-class commodity."

Gravel and Traffic

Fortunately, these evils, along with many others, have been practically eliminated. The average traffic man realizes that the only thing a railroad has to sell is transportation, and consequently he in-

voluntarily becomes a salesman along with the gravel man, realizing that neither can make money unless both do.

The gravel business enjoys (?) the distinction of being practically the only commodity shipped on which the freight rate equals or exceeds the production price of the material; and this condition has of late years become more exaggerated by the fact that freight rates on sand and gravel have increased 100 per cent, whereas the selling price is limited to practically an increase of 50 per cent on pre-war prices.

"Bicycles and Gravel"

Getting back to conditions in the early days, to show the low importance attached to the business, even by those engaged in it, I must mention a pair of partners I had along in the '90's who had inherited a fair deposit of gravel in what would be today considered a very desirable locality. They had constructed a small makeshift plant, the power unit of which consisted of a tractor engine, and the large sign attached to their small office building informed the public that they were "dealers in bicycles and gravel." In other words, the selling of a bicycle was of more importance than the closing of a contract for a trainload of gravel.

After a very discouraging first year's operation of our original plant, we undertook to exchange a bill of sale on our entire holding with the president of a railroad company on whose land the plant was located for a clearance on about $5000 worth of indebtedness the railroad company held against us. It was our good fortune to be dealing with one of those rare combinations so seldom found in one individual, that is business man and railroad president, who refused our proposition and in turn offered some very good advice, which was to look for our money where we had lost it, furthermore agreeing to assist us in any way possible with legal regulations governing railroads.

Gravel Grows on Trees

In those days, when politicians at Washington were masquerading as railroad men, a railroad could be pretty liberal in its transactions. That this particular railroad man showed good judgment in encouraging an infant industry has been clearly demonstrated by the fact that his road has enjoyed the movement of 18,000 cars per season from this same industry for the past 25 years.

I recall with considerable amusement the idea of the general public regarding gravel in the early days. As a matter of fact, if one stated to some individuals presumably possessed of the average degree of intelligence that he was in the gravel business they would frequently ask him if he got his supplies from the hills in northern Indiana, which they had noticed while riding through the sand dune district in the Twentieth Century; and in the explanation which would follow I presume one could get away with the information that gravel grew on trees, with a fresh crop every year.

Coming down to the prospective, and we might say attractive features of the business, it is highly gratifying to view the progress made in the last 25 years, or particularly the last 10 years, not the least feature of which is the development of bright young men who have enlisted in the business. It is difficult to find a successful concern in our line at the present time which has not associated with it, either as officers or employes, several snappy, rustling individuals who frequently specialize either as salesmen, engineers or traffic men, and occasionally a combination of all three.

For the first few years of gravel industry promotion it seemed as though the crushed stone people had it on us by virtue of a bunch of brains they possessed which were apparently lacking in our own branch of the game. Naturally they were strong competitors and never failed to take whatever advantage they had of experience and organization. Of late years there has been a great tendency on the part of the gravel and stone producers to fraternize in a common-sense businesslike manner, realizing that each material has its own particular use and that there is plenty of demand for all of it.

Competitors But Friends

During a recent session on the repair track with the flu, I received a letter from the president of one of the largest stone companies in the country (which by its location is also one of our principal competitors) expressing both good wishes and advice which did me more good than a prescription from my doctor. (This, by the way, may be due to the fact that my doctor is a disciple of Volstead and does not believe in "prescriptions" in the common acceptance of the term today.)

The gravel business has assumed such proportions that the matter of large jobs or contracts are really every-day occurrences. I think perhaps the one contract which was most gratifying to our company was the track elevation work done by the Chicago Junction railroad from Lake Michigan to the stock yards, as it was the first track elevation work done in Chicago for which gravel was furnished exclusively for concrete; also the first job of mixing the fine and coarse aggregates for this work at the plant. At the conclusion of the job we received a letter from the contractor complimenting us on both the quality of the material and service we had rendered, and stating that he had made a saving of 12½ per cent over his cost estimate on the handling of our product.

The last track elevation work done by the Rock Island road previous to war time is also a monument showing what can be done with a combination of good engineering and good material. One of our plants furnished the material for this entire job covering concrete retaining walls, filling and ballast, and at one point this represented three grade separations, two steam roads and one street, including a street-car line.

Naturally one takes considerable interest in the engineering end of the various jobs for which he furnishes material, and perhaps nothing has been more pleasing along this line than the job on the Illinois Waterway recently completed at Marseilles, Ill., which is generally admitted by both engineers and laymen to be a 100 per cent installation of concrete.

How the Business Grew

A contrast between primitive equipment and plant capacity with the present day is surely illuminating and is perhaps fairly well demonstrated by the fact that the first shovel installed in a gravel pit for plant loading weighed 45 tons and cost $2000 (second hand), while the last machine purchased by this company weighs 175 tons and the cost price was $65,000.

Plant capacity shows comparatively the same increase, as 25 cars, 60,000 lb. capacity, was originally counted a large daily output, whereas one plant, constructed this year, has shown a daily output of 85 cars, 100,000 lb. capacity, during the first 40 days' operation.

A Real American Career

The writer was born at Elgin, Ill., in 1867; finished school at the age of 11 years; tackled the farm without having taken a college course in agriculture; graduated from the farm through the country grocery store, creamery and milk business in Chicago; took a twist at real estate in the building of a suburban town, and as before stated, lit in the gravel business after trying to be a road contractor. Married in 1890 and raised three children, one of whom, George W., is associated with him as sales manager of the Chicago Gravel Co. and Illinois Sand and Gravel Co. Politics, Democrat, and generally vote for a Republican as most of my friends are that persuasion. Thirty-second degree Mason, Shriner and Elk. President of the Chicago Gravel Co., and Illinois Sand and Gravel Co.; vice-president of the American Sand and Gravel Co., the output of which three companies now amounts to nearly 4,000,000 tons per year. No particular hobby except gravel, and don't ride that as hard as formerly, as the younger members of our organization seem to do a better job at it.

The Geology of Glass Sands

The Origin of the Great Deposits of Silica Sands Which are of So Much Commercial Importance to New Jersey, Pennsylvania, Ohio, Illinois and Missouri

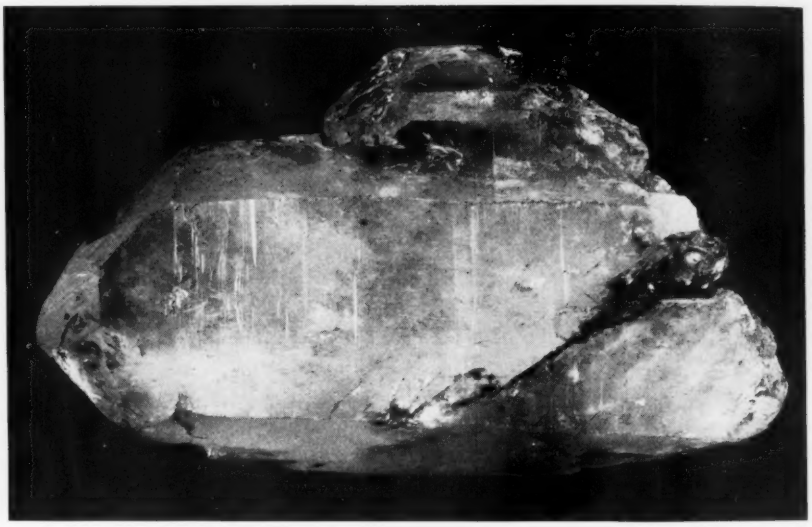
By Howard West Elkington
Philadelphia Quartz Co.

SAND is the common name for a very large mineral family. Nature has been not only generous but almost profligate with the deposits of sand in the United States. In considering the sand suitable for glass making, we can discard most of the members of the sand family and confine our attention to those sands which are relatively free from iron and have a high silica content. An ordinary glass sand should have less than 0.28 per cent iron (.20 per cent Fe_2O_3) and more than 98 per cent SiO_2. The layman will naturally ask in what way can such a tiny trace of iron make a difference to the manufacturer. To this question the glass maker will reply with some heat that, impossible as it may seem, one-half of one grain in 100 grains of sand can affect the color of his glass to such a degree that it will spoil a batch.

The Much Prized High Silica Sand

The fundamental reason why iron is so disproportionally disturbing is not clear, even to the glass maker. It is much more obvious why a high silica content is desirable. Some sands contain an almost negligible amount of iron and are practically pure silica. They analyze less than .02 per cent iron and are more than 99 per cent silica. These sands are much sought after by glass makers and it is the descriptions of the deposits of such sands that this paper will take up, although there are other interesting members of this fascinating sand family which we are loath to desert.

The illustration of a large crystal of quartz shows a giant member of the glass sand mineral group, the tiny members of which are of such importance to the glass maker. But it is not entirely accurate to consider all sand as originating in quartz crystals, for some glass sands are laid down in silicious beds and, even upon close microscopic examination show only slight crystalline structure. However, it is safe to say that the majority of glass sands are the surviving heirs of crystals or crystalline formations. If such a statement is followed, it almost strains the imagination and takes one back over vast periods of geologic time, a most romantic journey to the painstaking geologist.



An exceptionally fine photograph of a quartz crystals. Such crystals are the "parents" of most glass sands

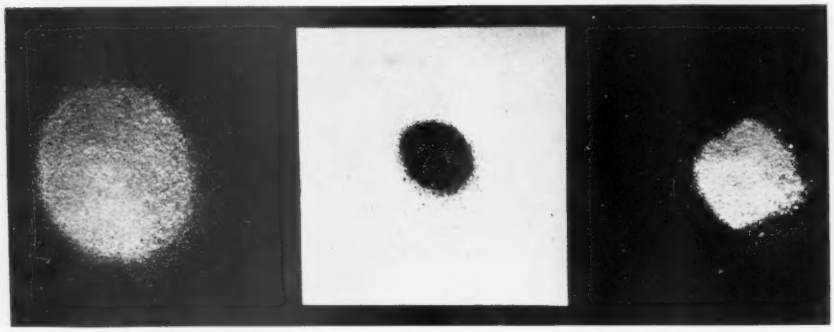


Fig. 3—On the left, sand with ilmenite and rutile, as shown in Figs. 1 and 2. Right, the clean sand and, center, the ilmenite and rutile which have been removed by a mechanical shaker

Before this is illustrated in full detail, consider the five large glass sand producing fields which are in New Jersey, Pennsylvania, Ohio, Illinois and Missouri. Many readers may be familiar with the sands of the Jersey shore. It is not these but sands of the interior which attract our attention. These sands in the interior are, generally speaking, refuse sands; that is, they are deposits of quartz grains laid down in lens-shaped beds, due directly to the geologic conditions under which this region was prepared. Because every grain in this area has had a checkered and tumbled past, the grains generally show smooth edges and signs of much wear. For a similar reason, although some beds of Jersey sand are relatively rich in grains of a low iron and high silica content, the beds as a whole are badly contaminated

by other refuse materials. The geologist would expect to find no other state of affairs in a region that is built up as a result of the disintegration of large land masses by the destructive action of the weather and the freakish deposition of the sea on a badly disturbed floor.

Deposits of a similar formation exist in the state of Delaware along the Chesapeake basin. In fact there are many parts of the country in which such shore conditions occur. Although the history of such sands has been tempestuous, they are, for the most part, of relatively recent origin. They have been subjected to little surface pressure and may truthfully be called young.

The cut shows a (Fig. 1) magnified picture of Jersey sand which is quite white to the naked eye but, when passed over a mechanical shaker, separates into grains of pure quartz, grains of rutile, brookite,

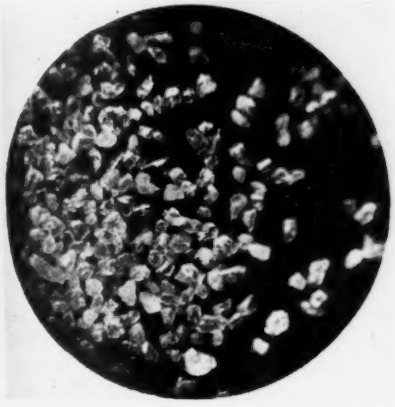


Fig. 1—Grains of New Jersey sand, typically irregular, pitted and mixed with grains of ilmenite. Magnified 15 diameters (15X)

octahedrite (titanium oxide) and grains of ilmanite, which is an oxide of titanium and iron. Ilmanite is easily observable in practically all New Jersey sand on close examination. It is these tiny specks of other minerals than silica which are quite heavy in iron and so troublesome to the glass maker.

The Oriskan Sea

In central Pennsylvania one sees outcrops of one of the oldest sand deposits in the United States. During the early part of the Devonian period an arm of the sea stretched from the northeast to the southwest, across western Massachusetts, eastern New York, through Pennsylvania, continuing into Maryland and West Virginia and Kentucky. This arm is called the Oriskan Sea. Following this, many tons of the earth's crust were subsequently deposited and finally subjected to the terrific pressure of the Appalachian uplift which produced the Appalachian mountains.

Picture a pocket handkerchief laid out flat, then pushed by pressure from the sides into ridges, then the tops of the

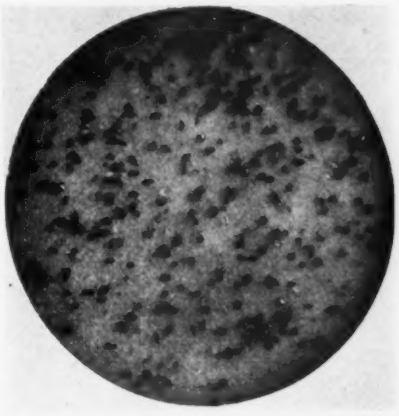


Fig. 2—The ilmenite and rutile grains are sharply crystalline as compared with the rough grains of quartz shown in Fig. 1. Mag. 15X

ridges clipped off with scissors and you will have exactly the same effects illustracted as are shown by the exposed edges or outcrops of the Oriskan sandstone in the mountains of Pennsylvania. Naturally such sand deposits have been consolidated both by heat and pressure into a sandstone of much firmness. There are edges where the weather has partially reduced the deposits. At such points the sandstone is more or less friable. But for the most part sand from this region must be crushed before it is fit for industry. Such sand is consequently sharp in grain and quite free from the contaminations of

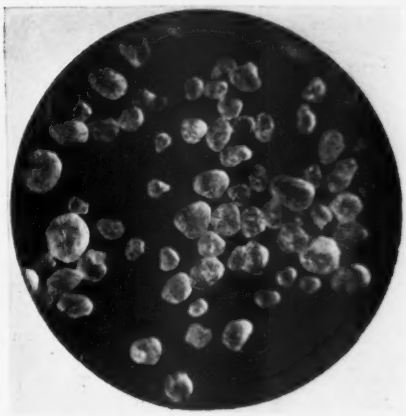


Fig. 5—The "fortunate" Illinois sands which have been twice sorted by water and once by wind. Note that the grains are so round as to be almost spherical. Mag. 15X

formation to which the Jersey sands have been subjected.

Space does not permit a detailed description of the deposits of western Pennsylvania, where recrystallization has taken place under the lateral pressure of the Permian. Omitting also the description of the Toledo district of Ohio, we will pass to the north central portion of Illinois, where one finds deposits of sand of extraordinary purity and equally extraordinary physical characteristics. Examination of the cut made from a magnified photograph of grains from this field shows that they have smooth, rounded edges and that they are extremely free from contamination. So marked are these characteristics that one wonders what conditions could have produced such a sand.

A glance at the map suggests that the waters of the Gulf of Mexico have been spilled off the United States, much as one might spill water off a great sheet. The geologist again takes us back over the countless years to the Ordovician age, when the interior of our country was for the most part a great inland sea. Reference

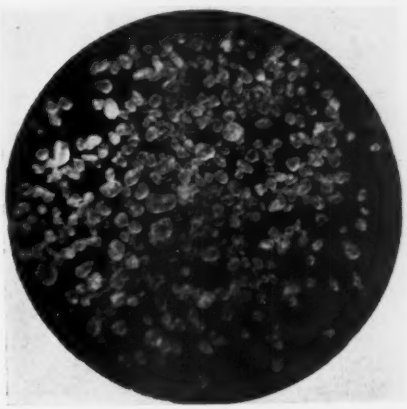


Fig. 4—Typical Missouri glass sand. The grains have rounded edges and are homogeneous. Mag. 15X

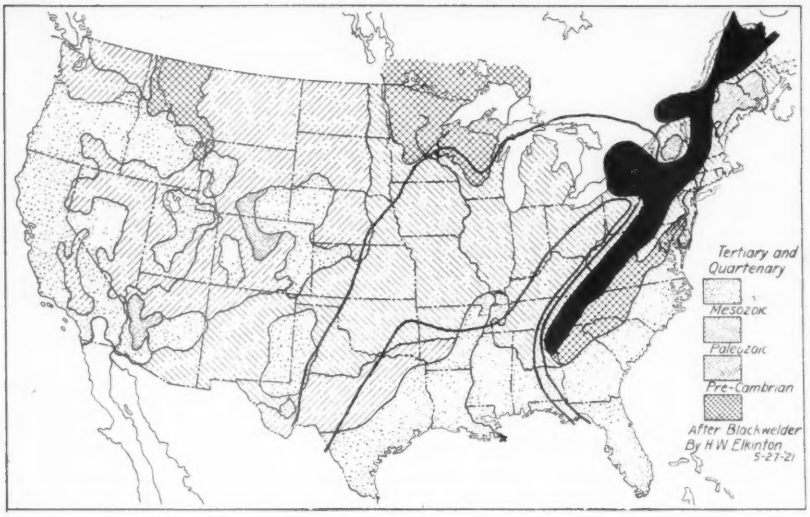
to the map of the geologic periods will make this clear.

St. Peter's Time

There was a period during this age when the inland sea extended from the middle of Kansas north to the middle of Michigan, east to southern Canada and south along the western edge of the Appalachian land. The period of the sea's greatest advance is known by the rather captivating name of St. Peter's time. Naturally, sandy stretches were laid down exactly as the sea creates sandy wastes on its shore today. In Illinois much sand was laid down at the time of the sea's greatest advance. The sea later retreated, withdrawing the shore edge from, roughly, the middle of Texas to the middle of Arkansas and extending obliquely to the southwestern corner of New York and south again along the barrier of Appalachia.

Wind Sorted Sands

This period is known to the rock reader



Geologic map of the United States. The black area is the Oriskan sea and the heavy lines show the boundary of the inland sea of St. Peter's time

as mid-St. Peter's time. It was during this period that the sand in the Illinois deposits is supposed to have been shifted by the winds, moved in dunes and subjected to a very thorough sorting.

We should remember that of the two kinds of mechanical sorting, washing and blowing, the latter is by all odds the most efficient. In blowing, large grains will quickly drop and fine grains will be carried much farther. In fact it is possible for the grains from a given dune to be separated by the wind a distance of many miles. In the same manner grains of quartz which have a different specific gravity from grains of feldspar or mica or other refuse minerals in the original beach, may be fanned by the wind and completely freed from their associates.

Washed and Sorted by Nature

But the Illinois region was even more fortunate, for the sea returned at the end of St. Peter's time to its northernmost border, so that a sand which was laid down by water was sorted by wind and again washed by water. As a result, the dust that is continually created by the moving of a dune was removed by a most opportune washing. The sand was thus left for man to use. But do not conclude from this that the sand does not have to be prepared for its use in the industries. Alas, it is in the bank and not in the manufacturer's bin. Even where she has done her best for him, Nature has had to leave a little work for the sand producer and the railroads.

This same deposit crops out in eastern Missouri and at other points along this ancient shore, although the Illinois deposit is by all odds the largest producing field.

Other Curious Deposits

There are several other curious and interesting deposits of glass sand. For example, take Lake Majella, in southern California, where a silica deposit was laid down by the diatoms which produce silica. This deposit is not of real sand but of diatomaceous earth. In Louisiana there are several deposits which are of much interest to the geologist. One, which is most unexplainable, is a deposit of exceedingly pure sand in the delta of Horn Island. It would be impossible to mention all of the hundreds of deposits in this country, but the best sand of glass making grade can usually be identified with one or the other of the deposits which have been mentioned. The character of the grain and the formation of the deposit can lead an experienced observer to pretty accurate conclusions regarding its origin, pedigree and the way in which it was laid down.

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Japanese Cement Manufacturer Dies in Earthquake

(Prefacing his letter by saying "I got out of Tokyo just ahead of the earthquake," W. D. Hornaday, Rock Products' Japanese correspondent, writes of the death of one of the great empire builders of Japan, who was known to many Americans.—Editor.)

Tokyo, Japan, Sept. —.—Not only did the cement industry of Japan suffer enormous losses by the recent earthquake and fires in the destruction of manufacturing plants, but the catastrophe claimed the lives of a number of men who were prominently identified, financially and otherwise, with the development of this important resource. One of the most noted of these men who is on the missing list is Soichiro Asano, of Tokyo, chairman of the board of directors of the Asano Portland Cement Company, Ltd. He was also president of the Toyo Kisen Kaisha Steamship Company, which has long operated a line of trans-Pacific steamships, and he was largely financially interested in various other enterprises of Japan. To foreigners who visited Japan he was perhaps the best known of all Japanese, for the reason that for several years he has made it a practice of giving these visitors who came over on his steamships a friendly personal welcome, usually entertaining them with a garden party in his beautiful home, which is now in ruins.

Pioneer in Cement Industry

Mr. Asano was especially interested in the growth of the Asano Portland Cement Company, it is stated. He established the industry in 1884, and may be said to have been the pioneer in this field in Japan. The company had a capital stock of 33,000,000 yen, equivalent to $16,500,000 United States currency. Its plants had a total annual output of 7,500,000 casks of cement. It had factories and offices at Tokyo, Moji, Hokkaido, Kawasaki, and Taiwan. The general manager of the company is Taijiro Asano, whose fate is as yet unknown.

It is apparent that Japan will be unable to supply a very small part, if any, of the needs in the way of cement for the rebuilding of the destroyed buildings of the cities of Tokyo, Yokohama and Nagoya. Most of the cement, as well as other construction materials, will have to come from the United States. It is expected that rush orders for enormous quantities of cement will soon be placed in the United States for shipment to Japan. Reinforced concrete construction will be generally adopted in the erection of the larger buildings in the two cities, as they are now known to be capable of withstanding earthquake and fire better than brick or stone structures.

American architects and contractors will also be called upon to assist in the rebuilding of the destroyed cities, it is asserted. Although thousands of private fortunes were wiped out by the catastrophe, the imperial government and the municipalities are considering plans for giving financial assistance for rebuilding business buildings and residences. Money for these purposes will be borrowed in the United States and other countries, it is stated.

Plaster of Paris*

III—Fuel Consumption—Factors Affecting the Properties of Plaster

By A. Brittain, M.Sc., A.I.C., and C. Elliott, B.Sc.

PLASTER or paris develops heat when gauged with water due to the chemical combination of the water with the hemihydrate, in accordance with the equation: $2CaSO_4 . H_2O+3H_2O=2 (CaSO_4 . 2H_2O)+$ 3560 calories.

To convert 344 g. of dry gypsum, previously raised in temperature to the transition point into the hemihydrate, therefore, requires 3560 calories. If allowance is made for the heat needed to raise the temperature to the required point where conversion into plaster starts, and if we assume coal of 11,000 B.t.u. per pound, then theoretically to convert 1 ton of gypsum into plaster requires about 47 lb. From collected information we conclude that rotary calciners require on the average about 80 lb. per ton, American kettles about 140 lb. (maximum 200 lb., minimum 95 lb.), while the English open pans apparently require 350 lb., although this figure is considerably less than those given to us. It is obvious, however, that there is room for improvement in the English pans as regards fuel consumption. We felt that it would be interesting to examine the possibilities of gas-firing the pans by direct application of heat on to the pan bottom by Bunsen flames. This method of heating would abolish the costly brick settings and cheapen the cost generally. With this object in view a small experimental pan was made and tests were conducted. Judging from the initial experiments, one would expect a very considerable saving in initial cost, upkeep and fuel consumption, and since the control of the heat can be easily effected, there is no doubt that plaster of the desired quality can be produced in this way. This matter is being further investigated.

Some Factors Affecting the Properties of Plaster

It will be gathered from the first portion of this paper that while the hemihydrate is the essential component of a commercial plaster, the composition is of a somewhat complex nature, and there may be present in a freshly prepared plaster any or all of the following forms of calcium sulphate: (1) hemihydrate (mainly); (2) soluble anhydrite, which is hygroscopic and reverts to the hemihydrate; (3) slow-setting anhydrite which, although not hygroscopic, sets with water to a hard mass; (4) dead-burnt anhydrite, and (5) natural anhydrite, which do not set with water; (6) unchanged gypsum; (7) impurities.

According to the method of manufacture, the temperature, the rate and time of heating, as well as the size of material being calcined, so will the relative proportions of the constituents vary. Thus, when prepared at low controlled temperatures below 150 deg. C., as in English practice, the freshly calcined plaster will consist of hemihydrate (mainly), soluble anhydrite, small amounts of slow-setting anhydrite and some unchanged gypsum. After keeping, the soluble anhydrite reverts to hemihydrate and the final product consists of hemihydrate with small amounts of unchanged gypsum and slow-setting anhydrite.

A plaster prepared at high temperatures, up to 200 deg. C., as by the American system, or up to about 275 deg. C., as in the rotary calciners, would have as a main product soluble anhydrite, together with small amounts of gypsum, hemihydrate and slow-setting anhydrite. After keeping, the product will therefore consist of hemihydrate (mainly), slow-setting anhydrite and traces of gypsum.

In kilns or ovens where fire or hot gases are allowed to play directly on the gypsum, a proportion of dead-burnt plaster will be developed, so that the final product will consist of hemihydrate, slow-setting anhydrite, dead-burnt anhydrite and some gypsum. In addition, all commercial plasters contain impurities and hygroscopic moisture.

Table III shows the composition of some English and American plasters.

As each of the components will have its own particular effect upon the properties of the plaster, and as the proportions present will vary between fairly wide limits, the properties of such plasters will also show wide variations. We now propose to discuss in some detail the result of these various components upon the properties of a plaster.

Effect of Size of Particle on Setting Time and Tensile Strength

Since the first stage in the setting of plaster is the formation of a saturated solution of calcium sulphate, it is obvious that the quicker the calcium sulphate goes into solution the more rapidly will the plaster set. The greater the surface which is presented to the action of the water, the more rapidly will the calcium sulphate be dissolved with a correspondingly quicker set. In other words, plaster in a finely divided form would be expected to set more quickly than a coarse one calcined under the same conditions. This is actually found to be the case.

A commercial plaster (No. 1, Table III), after being graded, was tested for setting time and tensile strength. Using the same amount of water, viz., 35 per cent in each case, it was found that the setting time decreased with increased fineness, but that the tensile strength after seven days increased with increase in the fineness of the particles.

TABLE III.

Plaster Brand No.		Hemihydrate, $CaSO_4$, $\frac{1}{2} H_2O$ per cent	Gypsum per cent	Anhydr. $CaSO_4$, slow setting per cent	Anhydr. $CaSO_4$, dead burnt per cent	Hygroscopic H_2O per cent	Total impurities per cent	Setting time Vicat. Initial set mins.	Setting time Thermo. Final set mins.	Sizing test Through 100, Caught 100-mesh per cent	Sizing test Through 100, caught 150-mesh per cent	Sizing test Through 100-mesh per cent	Sizing test Through 150-mesh per cent
English	0	.....	.....	.....	.....	.....	.....	7½	34*	5.9	.....	94.1	.....
"	1	64.9	2.44	21.68	.....	1.58	9.4	11	31*	29.7	23.3	.....	47.0
"	2	68.95	2.0	20.2	.....	2.01	2.48	11	34*	36.3	42.4	.....	21.3
"	3	85.38	3.62	7.05	.....	1.7	2.2	....	27	1.0	.....	99.0	.....
"	4	86.32	3.33	5.25	.....	1.4	3.7	....	35	0.4	.....	99.6	.....
American	5	90.22	1.69	4.00	.....	1.25	2.28	....	....	9.8	.....	91.2	.....
"	6	86.63	1.92	7.7	.....	1.25	2.70	17	32	7.0	.....	93.0	.....
"	7	67.2	5.31	16.4	.....	0.9	2.8	....	33	4.0	.....	96.0	.....
"	8	66.95	5.00	19.25	.....	0.9	2.2	17	30	3.5	.....	96.5	.....

In samples 0, 1, and 2, the setting times were taken with 65 per cent plaster and 35 per cent water. Examples 3 to 8 are taken from Winterbottom, "Gypsum and Plaster of Paris," and the setting times are taken with 59 per cent plaster and 41 per cent water.

TABLE IV.

No.	Size of particle	Vicat needle. Initial set	Thermo. Final set	Tensile strength. Lb. per sq. in.
1	Caught on 80-mesh.....	13	41	282
2	Pass 80, caught 100....	10	32	330
3	Pass 100, caught 150..	7	26	336
4	Pass 150.....	5	21	340

These facts are quite recognized, and it is customary in many works to regrind the plaster after calcination. This gives a stronger plaster and decreases the setting time. This regrinding, however, introduces a new factor, the acceleration of setting time not being due entirely to the increased fineness of the material.

Effect of Gypsum on Setting Time and Tensile Strength

All commercially prepared plasters contain unchanged gypsum. Even in finely ground plasters prepared by the American method, where the calcination has been allowed to proceed beyond the first settle to the soluble anhydrite stage, small amounts of gypsum still exist.

Even in plasters which are over-calcined, as in examples 1, 2, 7 and 8 (Table III), the amount of gypsum present is quite appreciable.

As the setting is due to crystallization of the dihydrate, the particles of unchanged gypsum present act as a nucleus around which the crystallization proceeds. The greater the number of free particles of gypsum which are present in a plaster the more quickly will crystallization and therefore the setting occur. In plasters which are not ground after calcination, particles of gypsum are embedded in a jacket of hemihydrate, soluble anhydrite or possibly within a film of slow-setting anhydrite, which renders them ineffective as nuclei around which crystallization can proceed. There is a period of suspension, therefore, after the solution has become saturated before crystallization commences, owing to the absence of nuclei. If, however, the plaster is ground after the calcination, some of the particles of gypsum are set free, the period of suspension before the crystallization commences is appreciably shortened, and in consequence the setting time of the plaster is accelerated.

In a properly calcined plaster, the amount of unchanged gypsum will be at a minimum, and although it helps in the setting of the plaster it cannot enter into the crystallization but simply acts as an impurity. In this respect it is an undesirable constituent, since it reduces the strength of the material when set.

The following table illustrates these points, viz., (1) the accelerating effect of free gypsum, (2) the reduction of the tensile strength of the set plaster by the presence of gypsum.

TABLE V.

Test No.	Plaster	Per cent Gypsum	Setting time. Vicat needle. Initial set	Thermo. Final set	Tensile strength. Lb. per sq. in.
1	Table III., No. 0	.....	7½	34	372
2	" " "	1.0	6	26	365
3	" " "	5.0	4½	21	340
4	" " "	10.0	.....	....	321
5	" " "	15.0	.....	....	282

These tests were made with 35 per cent water, 65 per cent plaster mixtures.

Effect of Dead-Burnt Plaster on Setting Time and Tensile Strength

In the same way dead-burnt plaster and the usual impurities that are found in commercial plasters, viz., silica, alumina and iron oxide, act as inert substances and reduce the tensile strength of the set plaster, but have no effect on the setting time. Table VI shows the reduction of the tensile strength due to presence of dead-burnt plaster, the tests being made with 35 per cent water, 65 per cent plaster.

TABLE VI.

Plaster	Per cent Anhydrite	Setting time. Vicat needle. Initial set	Thermo. Final set	Tensile strength. Lb. per sq. in.
Table III., No. 1	....	11	34	374
	5	10	32	361
	10	12½	34	320
	15	14½	35	290

In this connection it is to be noted that the addition of dead-burnt plaster has no effect on the final setting point. This result is not in accordance with that obtained by O. Frey (J., 1910, 354), who states that quick-setting plaster of paris may be converted into slow-setting plaster by adding a suitable quantity of flooring or dead-burnt plaster.

The rate of setting of plaster can be controlled within certain limits by the extent of calcination. In this connection Winterbottom (*loc. cit.*) remarks that the development of slow-setting anhydrite through a high temperature or a prolonged calcination will retard the setting of plaster. While this may be so, and in certain cases where the plaster is not reground after calcination, its effect may be appreciable, it is possible for plaster having a large amount of this anhydrous modification to have a fairly short setting time. Thus, plaster No. 1 (Table III), gaged with 35 per cent water, had an initial set of 7 min. and a final set of 25 min., although it contained 21.68 per cent of slow-setting anhydrite. This quick set is no doubt due to the enormous accelerating power of gypsum, which more than counterbalances the retarding effect of the slow-setting anhydrite when present in a suitable condition.

Certain Substances in Small Amounts Which Act as Accelerators

Many commercial plasters contain small percentages of sodium and magnesium sulphates, usually in approximately equal amounts, which act as accelerators, sodium sulphate having the most powerful effect (Canals, J. Pharm. Chim., 1915, 11, 286-290).

Gypsum is sometimes found containing sodium and magnesium chlorides as impurities. Plasters made from such gypsums would soon deteriorate. Owing to the hygroscopic nature of such salts moisture is absorbed from the air and taken up by the plaster, which rehydrates to the dihydrate, thereby "killing" the plaster. Experiments conducted by Winterbottom (*loc. cit.*, p. 122) show that plasters made from gypsum containing 0.5 per cent of salt and small quantities of other hygroscopic salts deteriorate very rapidly on being exposed to air during damp weather, while samples made from washed gypsum, which did not contain such salts, did not show deterioration.

While our object throughout this paper has been to discuss the effect of different components naturally occurring in plasters, upon the properties of the material, it is to be noticed in passing that the properties of a plaster can be considerably modified by the addition of various substances.

Canals (J. Pharm. Chim., 1916, 14, 33-37, 78-83) and also Rohland (Z. Elektrochem, 1908, 14, 421-422) consider that any substance which will increase the solubility, for example, sulphates, chlorides, nitrates, bromides, iodides of sodium and potassium; ammonium, sodium and potassium hydroxides, meneral acids, potassium carbonate, etc., will accelerate the setting of plaster. On the other hand, any substance which reduces the solubility—e. g., boric acid, borax, sodium and potassium silicates, sodium, calcium and magnesium carbonates and colloidal substances will retard the set. Rohland remarks that, although no exception to this rule was found, certain salts such as sodium chloride and ammonium sulphate affect the solubility of calcium sulphate, according to the concentrations, in opposite directions, and that they can either hasten or retard hydration. Thus, sodium, potassium and magnesium sulphates in small concentration retard hydration. At greater concentrations they accelerate it, owing to the formation of complex "ions" (Rohland, Z. anorg. Chem., 1914, 89, 352-354).

Hydration takes place in solution only, and since the hemihydrate is much more soluble than the dihydrate, the solution becomes saturated with the latter, which separates as a solid. This process naturally takes place more rapidly in the presence of any substance which can increase the solubility of the hemihydrate.

This explanation, of course, cannot hold for the remarkable accelerating effect of gypsum, which cannot increase the solubility of the hemihydrate, but accelerates the setting by forming a nucleus around which crystallization can proceed.

(To be continued)

Big Gypsum Deposit in Canada

A TORONTO, Canada, dispatch to the Spokane, Wash., *Review* says that J. W. Lyons, provincial minister of lands and forests, announced today the discovery of "one of the world's most important gypsum beds." The deposit, according to the announcement, is 99.8 per cent pure and extends 10 miles inland for a mile along a branch of the Mosse river, midway between Cochrane and James bay.

The Profits in Cement Manufacture

FOR the first time in the history of the cement industry in the East, an impartial analysis of the profits of cement manufacturers, made by H. Parker Willis, Professor of Banking at Columbia University, has just been completed. Professor Willis' report covers earnings and operations for the year 1922. It is based on the operating returns of 11 of the principal Eastern cement companies as reported in their income tax statements to the United States Treasury Department. These companies produce 75 per cent of the portland cement manufactured in the Eastern states.

According to Professor Willis' report, the 11 companies whose operating figures were analyzed, show an average return on their actual investment of about 7.3 per cent for the entire group. Returns earned by the individual companies vary widely. Several were operated at a net loss and the largest percentage of return was by no means obtained by the largest companies. It is also pointed out in this connection that the production of the mills covered in the report was the greatest in their history.

"It would appear," says Professor Willis, "that whether viewed as a return upon business turned over or upon the value of the output, or whether viewed as a return upon actual investment, the earnings of representative cement producers during the year 1922 have been well below the average obtained by industrial undertakings at large.

Prices Reduced

"From this point of view, too, it is noteworthy that the 11 companies under study materially reduced their prices during 1922, receiving on the average $.15257 less per barrel than in 1921. This figure represents the difference between an average 1921 price of $1.75453 and a price for 1922 of $1.60196 as reported."

Professor Willis's report follows:

In order to determine from an unprejudiced standpoint the operating results of the year 1922 as reflected in the position of the principal cement mills in the Eastern district of the United States, some leading producers of portland cement in that district recently offered to place their operating returns at my disposal with the request that I should analyze them and determine the facts shown for that year.

Eleven companies, producing over 75 per cent of the cement manufactured in the Eastern district, thus placed at my disposal their operating figures for the year 1922. I do not feel that the figures for the remaining companies in the Eastern district which are not at hand would materially change the facts presented as they represent less than 25 per cent of the production of the district.

The returns which I am presenting may, therefore, be taken as representative. They have in every case been based upon the income tax statements furnished by the concerns in question to the United States Treasury. They are, therefore, substantially uniform in their basis of computation besides being free of doubts as to accuracy which might exist were they merely the results of local bookkeeping, not checked up or adjusted to any general standard.

The industrial results of the year 1922 on the part of these mills have been the production of the largest volume of cement in their history.

For the eleven companies under consideration, this output was 28,774,191 bbl., or over 25 per cent of the entire product of the country as a whole. Gross sales of the eleven companies, comprising both new and old product, were worth $49,592,872.

The relationship between the output thus indicated and the capital invested will be inferred from the statement that the aggregate net worth of the invested property of the concerns as reported was $87,003,767.

The Relation Between Capital and Output

On this actual investment, the eleven mills have earned a total net income after expenses and taxes amounting to $6,363,461, or an average return of about 7.3 per cent for the entire group.

It is worth noting that great variations in the percentage of net earnings to net worth are found, some companies reporting only a fraction of 1 per cent as their net return, while others run higher in varying degrees. Several were operated at a net loss. It is also interesting to observe that the largest percentage of return is by no means obtained by the largest companies.

Total cash dividends declared during the year 1922 were $2,278,634, or an average percentage of slightly over 3.5 per cent on a total capitalization of $64,664,061 (reckoning both common and preferred stock as the basis of computation). Four companies declared no dividends whatever. Two stock dividends were declared, amounting together to $2,823,900, or slighty less than 4.6 per cent on the combined capitalization just mentioned.

In view of the fact that, during the discussions of industrial earnings in recent years, much has been made of statements that earnings returns were frequently vitiated by the existence of very large allowances for depreciation, it is especially worth comment that total allowances for depreciation and depletion of every kind aggregated, during the year 1922, for this group of companies, a total sum of $2,984,014, or the equivalent of about 3.4 per cent of the entire net worth of the group as already stated.

It would appear that whether viewed as a return upon business turnover or upon the value of the output; or whether viewed as a return upon actual investment, the earnings of representative cement producers during the year 1922 have been well below the average obtained by industrial undertakings at large.

From this point of view, too, it is noteworthy that the eleven companies under study materially reduced their prices during 1922, receiving on the average $0.15257 less per barrel than in 1921. This figure represents the difference between an average 1921 price of $1.75453 and a price for 1922 of $1.60196 as reported.

Indiana Cement Manufacturers Operating to Capacity

CEMENT manufacturers in Indiana, operating at or very close to capacity, have established a new high production record or record rate of production, according to a statement by Arthur Bradshaw, president of the Allied Coal and Material Co., past president of the National Builders' Supply Association. Production and distribution of cement in this state, he asserted, are at the highest rate in the history of the industry, and trade reports from the country as a whole apparently bear out Mr. Bradshaw's statement.

Much of this great production of cement is going into street and highway construction, which in the states of the Middle West is being carried on at an unprecedented rate. Cement mills at Mitchell, Greencastle and other points in southern Indiana are operating close to capacity and these manufacturers find it impossible to accumulate any reserve supplies. One plant situated at Mitchell, Ind., has a capacity of approximately 10,000 bbl. a day and from reports reaching dealers this plant during the present season has attained its full capacity in a few instances.

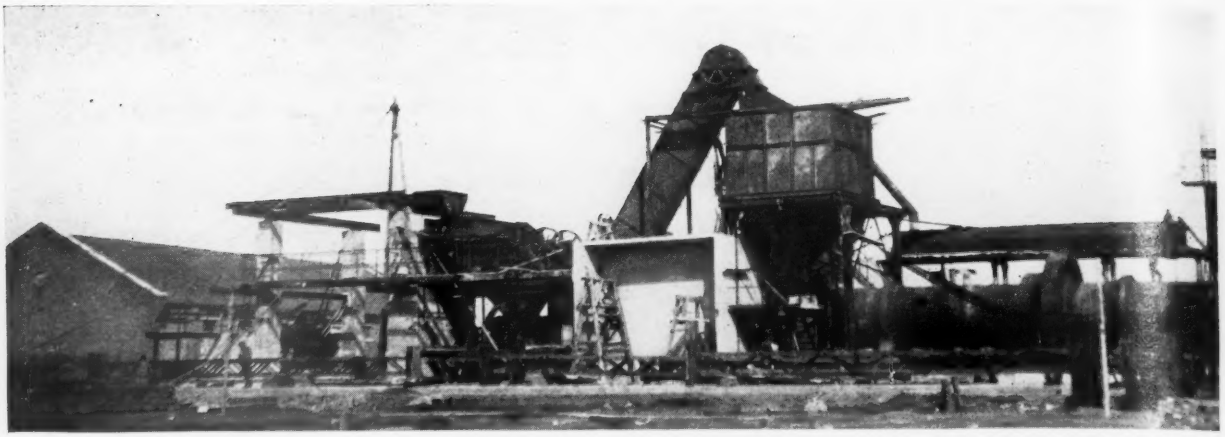
Notwithstanding that there was a decided lull in new building operations during the last five or six weeks, that situation was not reflected to any material degree in the cement industry nor in the sale and distribution of that product. The many uses of cement combine to give an unusually broad outlet and it is seldom that all kinds of consumers are out of the market.

"Production of cement thus far this year," Mr. Bradshaw said, "is at a new high record, and the sale and distribution of cement are about keeping pace with its manufacture. In fact, in some states the demand is ahead of production and dealers are paying premiums of as much as 40 cents a barrel for prompt delivery.

"At present production as I understand it is at a high record, as there are many large construction projects under way which call for a great supply of cement. The next 60 days, I believe, will be the busiest of the year for the cement manufacturer, for contractors are making efforts to complete their construction work before the advent of cold weather.

"Indiana is more fortunate this year in the way of adequate supplies of cement than some of the other states, for it has within its border and of easy access several large cement mills. Reports from Chicago and the Northwest are to the effect that dealers are paying premiums of as much as 40 cents a barrel for prompt delivery. That in itself indicates the urgent demand.

"The outlook for the cement industry is encouraging. More highway construction is bound to come, more building projects will be pushed forward and I can not see any letup during the coming year."



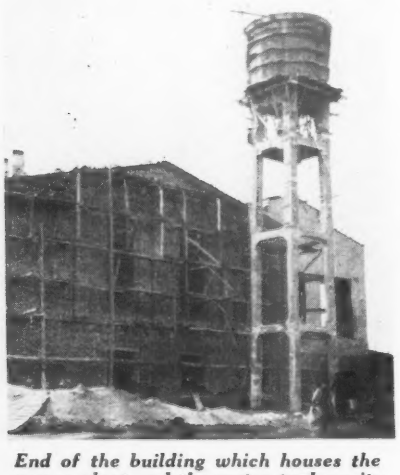
The start of operations at the Shanghai Portland Cement Co.'s plant. The clay is made into a paste and pumped to a storage tank and then fed into the "compound" mill. The limestone from the jaw crusher is elevated to the hopper and fed into the mill

The Shanghai Portland Cement Plant

An Entirely Modern Installation Which Will Now Be of the Greatest Economic Importance to the Orient

By M. H. Chou
Shanghai, China

ABOUT four years ago when the war had boosted the price of every article of commodity to the highest pitch, the cement boom was raging wild. The price of cement jumped from 4 taels to 8 taels, sometimes 11 taels per bbl. The demand of cement for construction work was so great that no more cement could be obtained even though very high prices were offered for it. At this moment, Mr. Liu Hong Son, a Ningponese, who had amassed a large fortune through his coal deal with the Kailan Mining Administration hit upon cement as his next industry.

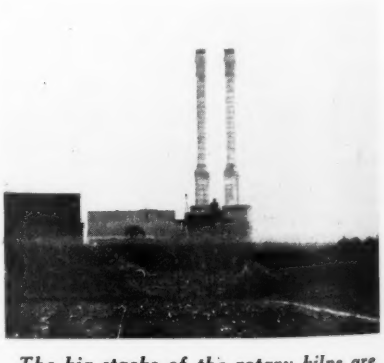


End of the building which houses the power plant and the water tank on its reinforced concrete tower

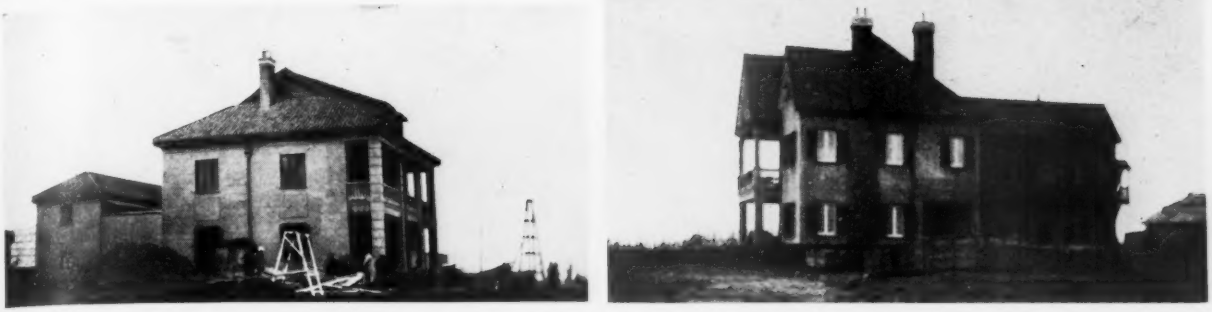
***THE ORIENT** will be a great market for building materials in the immediate future, especially for cement, as the new dispatches confirm the experience of other earthquake tests as to the resistance of reinforced concrete structures to earthquake shocks. Not much of this cement can come from the United States, for this country is already importing cement to supply its own needs. Europe and China must supply the demand that the Japanese cement mills cannot supply, and hence this article by a Chinese engineer (graduate of an American university) is particularly timely.*

He at once organized the Shanghai Portland Cement Co., Ltd., with a few prominent Shanghai business men, such as Chu Pao Shan. He also sent his cousin Liu Pao Lie to travel through the United States and Europe for the purchase of cement and power machinery.

A complete set of cement machinery was ordered from the Pereuseus Engineering Co., Germany. The capacity of the plant is to turn out 1200 bbl. per 24 hr. The power plant machinery was bought through the China Siemens Co. It consists of a steam turbine and motors which are able to generate 1500 kw. Babcock & Wilcox boilers are used for generating



The big stacks of the rotary kilns are of a design that appears unusual to American eyes



The company's offices, at the left, and the engineers' residence, at the right. So far as appearances go, these photographs might have been taken in the suburbs of Chicago or New York instead of Shanghai

steam. The steel columns for the main mill were also purchased in Germany. The cost for all these equipments is said to be over 700,000 taels c.i.f. Shanghai.

It is more or less the case that the land for the location of the mill should be bought at the place where the large stockholders are residing. Therefore a piece of 400 mows was bought (one mow equivalent to 1/6 of an English acre) at the price of 400 taels per mow (one tael equivalent to 90 cents gold). The land is located in Lunghua, one-half mile from the business center of Shanghai. It faces Whangpoo river on one side and the Soochow creek on the other.

The designing of the main cement mill was done by E. J. Muller, 17 Museum road, a Danish civil engineer of repute in Shanghai. The contract was awarded to Chang Fok Kee, one of the prominent Shanghai reinforced concrete contractors, at the approximate sum of 280,000 taels. The power house was designed by the engineering staff of the China Siemens Co.

The following buildings have been constructed: Cement mill, godown, power house, water tower, engineer's residence, main office and working man's house.

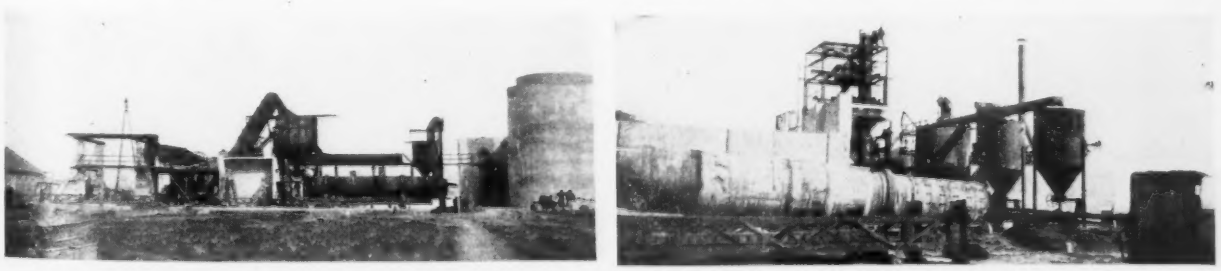
The machinery on the power plant was erected by the China Siemens Co., who sub-contracted the job to the Fah Sing Iron Works. The cement machinery was erected by day labor under the supervision of several German engineers who have been sent over by the company who sold this set of machinery. The whole plant will be finished in one year.

The operation of the whole plant is in the hands of the chief engineer, Mr. Molatoir, with the aid of several German chemists and engineers. The chief Chinese labor superintendent is Wang Wai San, who used to work for the Hupeh Cement Co., a subsidiary of the Chee Hsin Cement Co., and who has had over 10 years' experience in cement works.

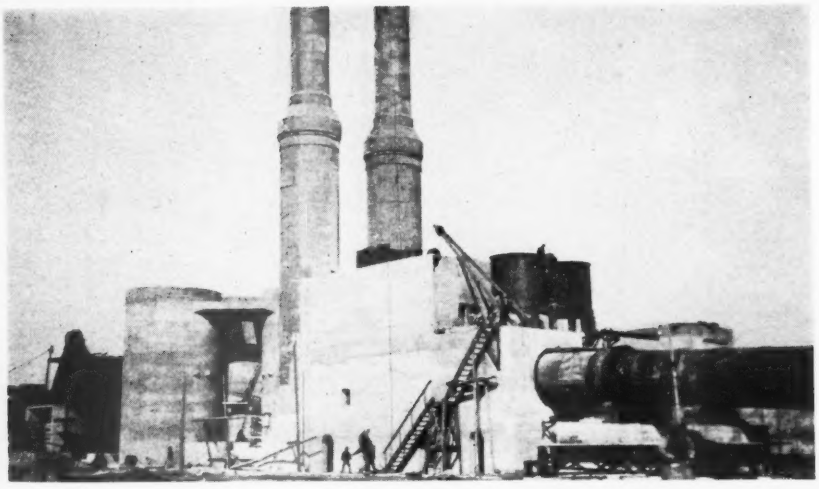
End of the kilns with coal storage tanks in background. Note the heavy concrete construction by comparing thickness of wall with height of men working on top

Raw materials used for cement manufacture are limestones and clay which have to be hauled over long distances to this plant. It is reported that limestone is quarried in Chih Kiang and hauled by the Shanghai-Nanking railway over a distance of 100 miles. It will cost at least $2 to $3 per ton of limestone for the handling. A little lower price has to be paid for the clay. Coal used has to come from the Kailan Mining Administration. About $12 or $13 Mexican has to be paid for one ton of coal. Gypsum, used to delay the setting time of cement, comes from Hankow and costs about $32 Mexican per ton.

Clay is made into paste in the clay sludge and pumped into a storage tank where it is fed into a compound mill together with the crushed limestone coming from the jaw crusher. Clay and limestone are ground into very finely divided paste by steel ball. The slurry is then pumped into three big storage tanks where sample for chemical analysis is taken. After it



At the left the clay and limestone handling equipment and the compound mill with the storage tanks at the end of the mill. At the right are the kilns. Note that everything is kept very close to the ground in this (Danish) engineer's design



End of kilns and bases of stacks taken while plant was under construction with storage tanks and grinding equipment in the rear

has been carefully determined in its chemical composition, it is fed into steel rotary kilns 180 ft. long which are lined with the best grade fire brick of the Kailan Mining Administration. On the other side of the kiln coal dust, carefully prepared, is pumped into it together with compressed air. It will develop a temperature of over 1500 deg. C. which will burn the slurry into clinker, which is carried by a chain hopper through an underground tunnel. After proper cooling and seasoning, the clinker, together with a certain proportion of gypsum, is ground in the compound mill by means of steel balls. The finished product is then conveyed by means of a screw conveyor to the cement silo where the final test of cement for its physical properties is made. After complying with the Chinese government specification it is packaged in steel drums, or wooden barrels or paper or jute bags. It may be shipped in bulk by trucks, whenever there is considerable construction going on in the immediate neighborhood.

Shanghai a Big Market

Shanghai is the biggest market for cement, for there are so many gigantic buildings being erected there which will cost over several million taels. Since the factory is near to Shanghai, a large proportion of its product will be sold there.

The brand adopted for the trade mark of their cement is Elephant.

J. L. Shiely Co. Enlarges Plant

PURCHASE by the J. L. Shiely Co. of gravel property at Newport and Mendota and the adoption of a program to spend $200,000 in plants at these two properties, in an enlargement to the present plant at Stewart avenue and Hathaway street and in a river terminal at the Stewart avenue plant and barge loading facilities at Mendota and Newport, are described as the largest sand and gravel development that has taken place in the Twin Cities.

The project will bring about for the first time water transportation of sand and gravel in St. Paul and Minneapolis and will make the St. Paul company the largest sand and gravel concern in this vicinity, it is stated in business circles.

Information regarding the land purchases and plans of the J. L. Shiely Co. furnishes the solution of the wonderment that has been felt for some time as to the reason for extensive optioning activities in Mendota. The Shiely negotiations were handled by Colonel L. H. Brittin, industrial engineer of the Greater St. Paul committee, and Den E. Lane, real estate man.

Large Stock Pile Facilities

The Shiely company's crushed rock plant and quarry are on the Stewart avenue property, a 75-acre tract. The company also has been carrying on sand and gravel operations on a Snelling avenue tract near the Great Northern railroad's Hamline station. The Snelling avenue operations will be discontinued next year as part of the new program, and the Shiely company will centralize its sand, gravel and crushed rock business at the Stewart avenue and Hathaway street property. In connection with the enlargement to the plant at this point there will be stock pile facilities for 75,000 tons. Barge lines to be established between the main plant and the Mendota and Newport properties, will bring sand and gravel to a water terminal to be established at the main plant, and the materials will be handled from the river to the plant by mechanical conveyors. The main plant at Stewart avenue is close to the expected development in the Ford district.

It is stated that the new plants will be in operation in time for next spring's building season.—*St. Paul Pioneer Press.*

Building Dam with Baled Straw and Sand

IN controlling the flow of hydraulically placed sand, which is beyond the present needs of the plant and which is placed in storage to be reclaimed by crane during the winter months, the Ward Sand and Gravel Co., Oxford, Mich., builds dams or dikes by alternating layers of baled straw and sand.

This construction makes a strong dam that can be built 3 or 4 ft. in height that retains the sand, allowing the water to flow off.

Cement Earnings Show an Increase

THE report of the International Cement Corp. for the second quarter of the current year shows net income of $636,710 after charges and taxes, equivalent, after preferred dividends, to $1.61 a share on the 364,467 shares of no par capital stock, against $460,209, or $1.19 a share, on 364,137 shares of common stock in the preceding quarter and $332,543, or 95 cents a share, on 324,722 shares in the same period of the previous year.

Sales amounted to $3,820,469, against $2,803,851 in the same quarter last year, while expenses and depreciation were $3,090,662, against $2,399,069. Total income was $739,625, against $406,882.

Net income of the International Cement Co. for the six months ended June 30 last was $1,096,920 after charges and taxes, equivalent to $2.74 a share, against $530,363, or $1.20 a share, for the same period of the previous year.

Pere Marquette Sand Traffic High

MANISTEE'S storied sand dunes are gradually being shipped to the Atlantic seaboard, according to the records of the Pere Marquette railway traffic department. For instance, during the last week of August no less than 213 carloads of Manistee sand was hauled eastward by that line.

Manistee sand has a particular character that makes it valuable to the foundry industry, and it is shipped generally where there is such a concern. The rate between Manistee and Boston is $6.70 a ton; Manistee and New York, $6.30 a ton; Manistee and Philadelphia, $5.90 a ton; Manistee and Baltimore, $5.70 a ton.

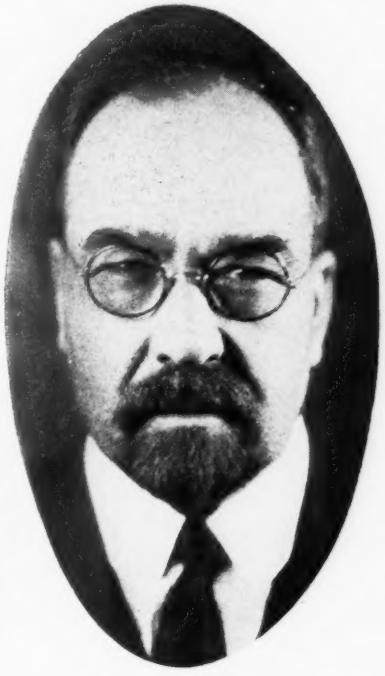
The shipment itself costs loaded at Manistee, approximately 10 per cent of the freight charges, and because of this very high freight rate, as compared with the cost of the commodity itself, it often occurs that a claim for loss en route is made for the rebating of the freight charge, while the loss of the commodity itself is ignored. —*Chicago Post.*

St. Louis to be Convention City National Crushed Stone Association

January 21 to 24, 1924, Selected as Date—Plans for Biggest Convention in History of Industry

PLANS are maturing for the biggest and best convention ever held by the quarry industry of America. The place selected is St. Louis, Mo., and the dates, Monday, Tuesday, Wednesday, and maybe Thursday, January 21 to 24 inclusive.

The Statler hotel, at St. Louis, has offered exceptionally attractive convention quarters, as the floor plan below shows.



F. W. Schmidt, of Morristown, N. J., President of the National Crushed Stone Association

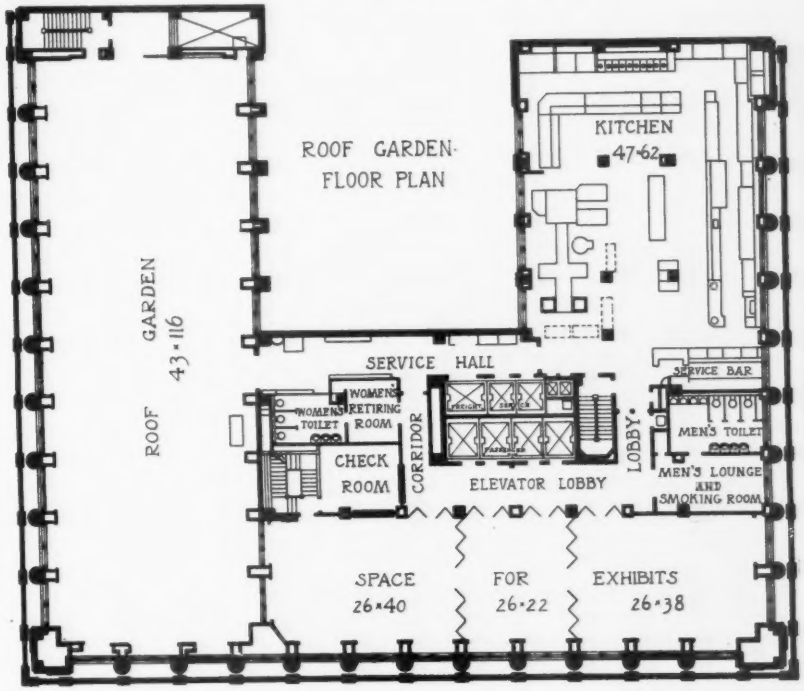
This is the entire top floor of the hotel, or roof garden, glassed in. Adjacent to the large meeting room is a long corridor or assembly hall where provision will be made for exhibits of models of quarry and plant machinery. Every facility will be provided here for demonstrating the new and standard equipment and machinery made by the associate members of the National Crushed Stone Association.

As yet no definite program has been developed, but it is expected that the discussion of both operating and business problems will occupy the major part of the convention, as was the case the year before. This time it is hoped to make the subjects more specific and less general, and to leave more time for discussion from the floor.

The scheme for daily group luncheons, such as were held at the last convention so successfully, will be another feature of the convention. Probably, as was the case at the last convention, Thursday will be largely devoted to a meeting of agricultural limestone producers.

St. Louis is ideally located for a crushed-stone convention, being perhaps as near the geographical center of the stone industry as any large city. At this time Missouri is a particularly interesting state to the crushed-stone industry because of the large state contracts for highway stone now pending.

There has never been a time in the history of the industry when so much "advance interest" was manifested in the coming convention. Every member is an enthusiastic booster, and it looks very much as if no live crushed-stone producer could afford to stay away from the 1924 convention. Better start making your hotel reservations now!



Plan of the roof garden floor of Hotel Statler, St. Louis, where the National Crushed Stone Association will meet in convention

Extends Asbestos Mine

EXTENSIONS and increased production are the order of the day in the asbestos producing area in the southern portion of the Province of Montreal. The Asbestos Corporation of Canada has now six large cable derricks in continuous use. The pit opening is now over 300x600 ft. at the surface and 345 ft. in depth at the lowest point. Work has been carried on actively on the removal of the overburden, so as to extend the workings. This covering in places reaches a thickness of 80 ft. The hydraulic system was given a trial but proved impractical and gave place to the present system of steam shovels and cars.

Wisconsin Plant Has Many Novel Features

Casco Gravel Co. Uses Internal Combustion Engines Throughout for Excavating, Transporting, Washing and Pumping Water

The washing plant differs in appearance from the usual type. The screen is set transversely to the bins and an elevator takes the place of the usual plant conveyor. Note the unusual slanting bin bottom and the doubled spouts for quick loading of cars

Lester Schneider, who was in charge of plant operations, obligingly posed with the latest copy of Rock Products

THE Casco Gravel Co.'s plant at Casco Junction, Wis., is one of the newer Wisconsin plants, and its design embodies some modern features. As examples, the power for all operations, excavating, transporting, washing and pumping, is obtained from internal combustion motors; a concrete water storage tank replaces the old slum pond, and the design of the washing plant is quite different from the ordinary plant in appearance.

A Plant That Is Built in Proportion to the Market It Supplies

This is a plant of comparatively small output, the production being from 500 to 600 tons per day. But it is no disparage-

The pit of the Casco Gravel Co., as it appeared during the 1922 season, showing the shovel at work. Normally, about a 15-ft. face is kept on the bank

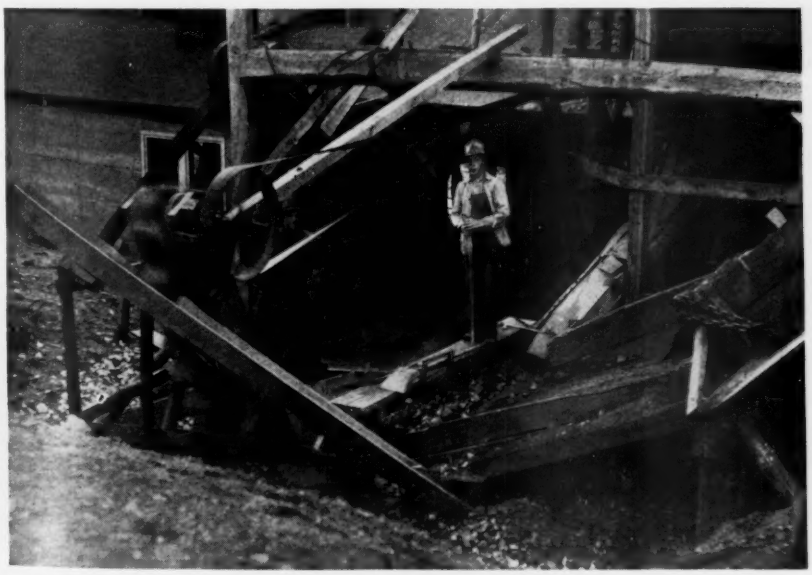
Internal combustion engines supply power for digging as well as washing. This is a gasoline power shovel with a ¾-yd. dipper, which is sufficient to keep the plant in operation

ment of a sand and gravel plant to say that its output is small, in fact it may indicate that the highest kind of engineering ability has been exercised in its design and operation. The production of a plant is limited by the market found within the area to which it can ship its product by rail. If this market can absorb no more than 500 tons per day, it would be a grave engineering error to erect a plant to handle a thousand tons. And in the design and operation of a small plant one may exercise quite as much engineering skill as would be needed to design the plant of much greater capacity.

The Deposit Is of a Type Common to Wisconsin and Other Northern States

The deposit from which the Casco plant draws its supply is a type not uncommon in Wisconsin, a flat deposit of not much depth but of a great area. Normally, the face of the cut in which the shovel works is about 15 ft. deep. In working such a deposit, the matter of transportation is of the greatest importance, as the excavating machine cannot work long in one spot. This calls for an industrial railroad, and the logical machine to load the cars is a power shovel.

An Austin gasoline shovel, with a ¾-yd. bucket, is used to do the excavating and the bank material is conveyed to the washing plant by a Burton gasoline locomotive. The cars are of the side dumping variety, made by the Western Wheeled Scraper Co.

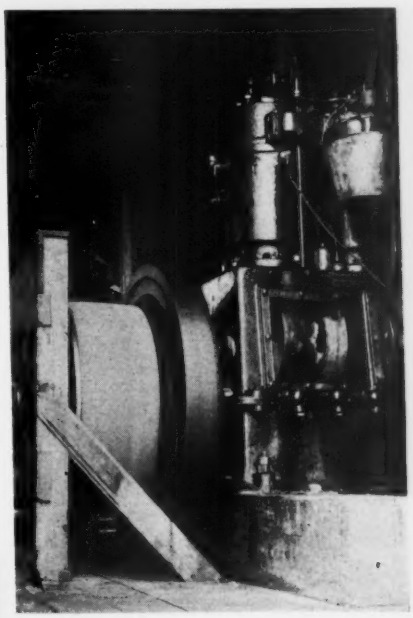


This grizzly, which sends the oversize to the jaw crusher, isn't steep enough to operate by gravity. At the left is the bucket elevator which returns the crushed gravel to the gravity chute which leads to the main elevator

The Grizzly

As the bank material is dumped from the cars, it passes over an inclined grizzly. As is usual with this arrangement, some trouble was found in getting the grizzly to clear itself by gravity alone, and a man or two had to be employed to assist the material in its flow. The grizzly is made of twenty-seven 1x2-in. bars, set on edge and spaced 2 in. apart.

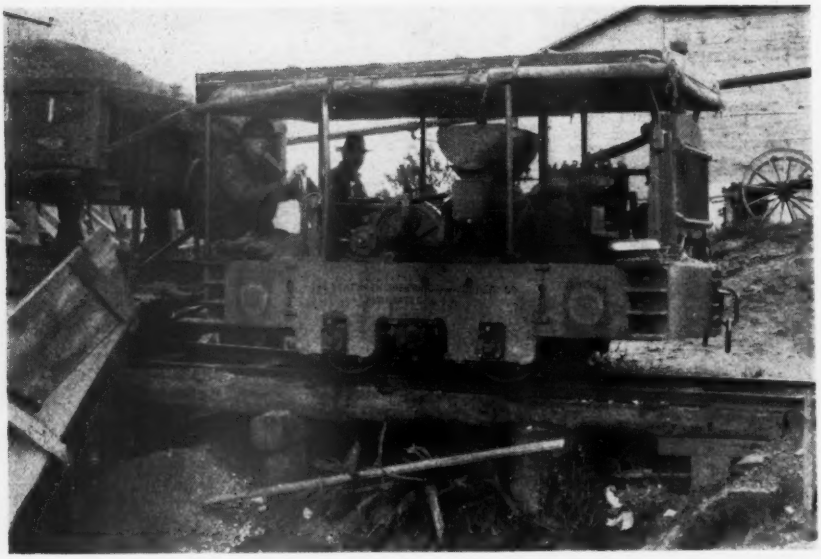
The undersize of the grizzly goes directly to the boot of the main bucket elevator which feeds the plant. The over-



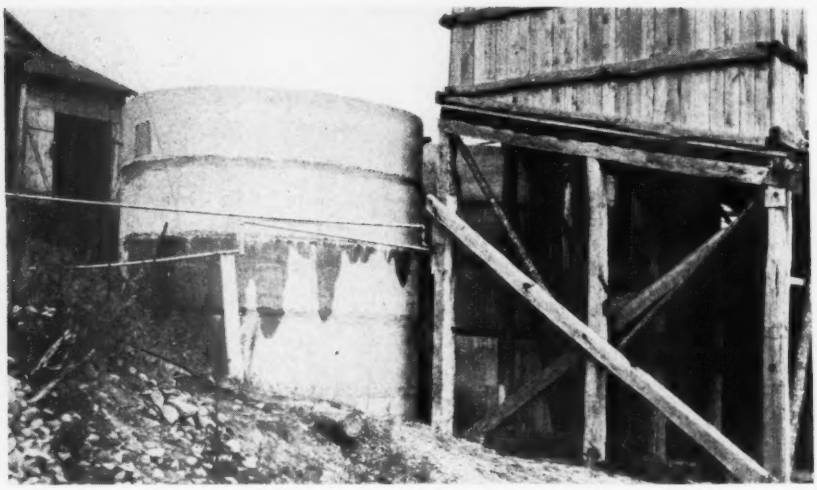
The main power unit is a 70-hp. vertical engine. Usually crude oil is the fuel but kerosene is used when crude oil cannot be obtained

size, which will not pass the bars, goes to a Universal jaw crusher. The crushed material does not directly join the undersize. It goes to a small elevator which lifts it to a chute down which it runs by gravity to the main elevator boot. This small elevator is 15 ft. between centers. The arrangement of grizzly, crusher, elevator and chute is very plainly shown in one of the accompanying photographs.

The main elevator, which feeds the plant is 70 ft. between centers. It delivers the fines and crushed material to an Austin screen which is 20 ft. long and 40 in. in diameter, located at the top of the plant. There are three sizes of perforations in the screen proper, ¾ in., 1 in. and 2 in. in diameter, all round holes. Outside of the screen is a dust jacket with ¼ in. perfora-



A Burton gasoline locomotive draws the cars from the pit



Concrete tanks store water from wells

Side dump cars ready to discharge into grizzly chute

tions. This screen makes thre sizes of gravel, which are sent to their spective bins, and sand, which flows to settling box from which it is removed a "sand ladder" of a not uncommon c. The oversize of the screen is retu d by a chute to the crusher.

A 3-in. pipe brings the water or washing, the water being added to the unwashed material as it enters the creen.

Washing Plant

The picture of the washing plant shows that the layout is somewhat different from the ordinary plant. In appearance it more resembles a common type of stone crushing plant, with the screen placed transversely to the bins and an elevator in place of the familiar belt conveyor to bring the bank material to the screen. The bins which have a capacity of 3 cars each, are of an unusual design, with a slanting floor and supported on posts, where such support is apparently not demanded by the necessity of loading from beneath the bins.

Power Installation Is One of the Interesting Features of the Plant

The power installation is one of the most interesting features of this plant, on account of the use of internal combustion engines. The main engine is a 70 hp. Kahlenberg vertical engine, using crude oil for fuel. This furnishes the power for the crusher, elevators, screen and sand ladder. When crude oil is not obtainable, kerosene is used with satisfactory results. The normal fuel consumption of this engine is 20 gal. of oil in 10 hr.

Gasoline Engines Drive Pumps

Wisconsin gasoline engines are used to drive the pumps that furnish the water supply. The water is obtained from wells by means of two deep well pumps. These discharge into three large concrete storage tanks, which are one of the unusual features of this plant. Each tank holds 13,500 gal., and the storage of so much water assures a steady supply during the working period of the day, while the pumps can be run at night, if necessary, to keep the tanks filled.

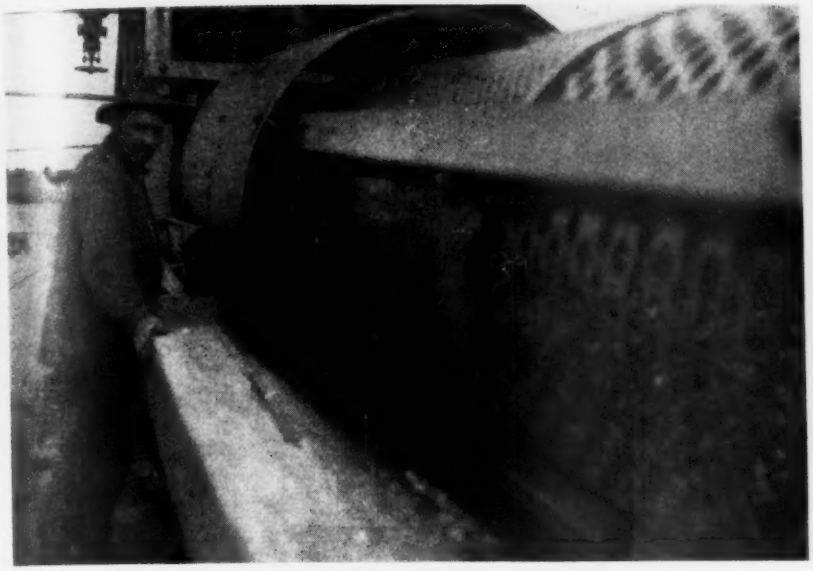
An American centrifugal pump sends the water from the tanks to the washing screen.

Plant on Green Bay & Western

The plant is located on the Green Bay and Western railroad and supplies a local market.

Mr. Lester Schneider was in charge of the plant operations at the time the plant was visited.

This plant is interesting, not only because it is a successful operation of comparatively small tonnage, but because the men who were responsible for its design



The screen is 40 in. in diameter and 20 ft. long. There are three sizes of perforation for gravel and a sandjacket outside which separates the sand

had the courage to work along unusual lines. The correctness of their judgment in doing this has been proven by more than two years of successful operation.

Canadian News From Rock Products Industries

By G. C. Keith, Toronto, Ont., Can.

THE Manitoba Stone Co. is considering the establishment of a branch plant at either Toronto or Hamilton.

The Crushed Stone Ltd., Kirkfield, Ont., has been incorporated with a capital of $40,000.

The Scotstown Granite Co., Ltd., Scotstown, Que., has been incorporated with a capital of $250,000.

The Durham Stone and Sand Co., Ltd., Toronto, Ont., has been incorporated with a capital of $500,000.

The Unic Cement Co., Ltd., Montreal, has been incorporated with a capital of $1,000,000.

The Wentworth Quarries, Ltd., Hamilton, has been incorporated with a capital of $200,000.

The Feldspar and Granite Ltd., Toronto, has been incorporated with an authorized capital of $500,000.

The Burnt River Quarries Ltd., Toronto, has been incorporated with a capital of $100,000.

Ontario Sand Co., Ltd., Toronto, has been incorporated with a capital of $100,000.

Brantford Sand and Gravel Co., Ltd., Brantford, has enlarged its plant and now has an output of 45 cars per day. The company has an authorized capital of $200,000.

It is officially announced that the Dominion Lime Co., of Lime Ridge, Que., has passed into the hands of the Brompton Pulp and Paper Co. at Sherbrooke, Que. The Dominion Lime Co. was established about 40 years ago and has been operating continually since the initial activities. Lime Ridge, Que., where the plant is located, is on the Maine Central. Plans have been prepared for a new lime-burning mill at a cost of $10,000.

A. Dupie & Co., quarrymasters, Montreal, have been registered.

Seymour Creek Sand and Gravel Co., Ltd., 626 Pender street W., Vancouver, B. C., has been incorporated with a capital of $10,000.

Greenborn Sand and Gravel Co., Ltd., has purchased the property and plant of W. P. Godson at Greenburn, Ont. G. A. McLeod is manager of the Toronto office at 33 Adelaide street W. The plant will be improved. Mr. McLeod was formerly connected with sand and stone interests in Halifax and Halifax interests are connected with the Toronto company.

Queenton Quarries, Ltd., St. Davids, Ont., contemplate extending the quarry and the addition of stone quarrying equipment.

Ottawa Gravel and Construction Co., Navan, Ont., has been incorporated with a capital of $50,000 by Marshall Rathwell and others.

A report from British Columbia states that the Portland Cement Co. is negotiating with Dr. Hall of New Westminster, B. C., for the latter's stone claims at Popkum. Should the deal go through, the cement company will start at once to develop the property.

The total sales of cement in Canada during 1922 reached 6,943,972 bbl., exceeding the previous year's total sales by 1,191,087 bbl. Sales from Ontario amounted to 3,104,000 bbl., averaging $2.06 per bbl.; and Quebec 2,660,000 bbl., averaging $2.22 per bbl. The selling prices in other provinces were: Manitoba, $2.62; Alberta, $2.33; British Columbia, $3.00. The average for the Dominion was $2.22 per bbl. for 1922.

The National Cement Co., Ltd., who are building a plant near Montreal, have 110 acres bounded by Pine avenue and Broadway. The plant will cost a million and a half and it is expected will be operating next year.

Several changes occurred in the Toronto staff of the Canada Cement Co., Ltd., this year. G. A. Grant, formerly assistant manager at Toronto, is now manager at Winnipeg, Man. Mr. Bovard, who was manager at Toronto, is now at the head office in Montreal as assistant general manager of sales. V. C. Moynes, formerly manager at Winnipeg, is now manager at Toronto.

The Mountain Stone Co., Ltd., Fort William, Ont., has been incorporated with a capital of $200,000. This company is erecting a modern rock crushing plant at the foot of Mount McKay to take out rock and treat it at the rate of 1000 tons per day. The rock will be used for elevator construction, railway ballast, etc. J F. Hewitson, a well-known local contractor of Port Arthur, Ont., is in charge of the plant. The plant will have seven electric and steam spur tracks from the local street railway and the C. N. R.

Nova Scotia may have some new lime mills as a result of the action of the Nova Scotia legislature encouraging the use of limestone on land. By an act of the legislature, the government paid a rebate on freight paid for ground limestone or marl produced in Nova Scotia of one-half the freight charges not exceeding $1 per ton between the dates of April 23 and July 31.

Gypsum production in Canada in 1922 amounted to 559,265 tons valued at $2,160,898, an increase of 172,715 tons and $375,360 over the figures for 1921. The quantity quarried by provinces was: Nova Scotia, 281,681 tons; New Brunswick, 56,692 tons; Ontario, 106,829 tons; Manitoba, 39,147 tons and British Columbia, 100 tons.

An excellent pamphlet describing the occurrences of silica sand in Canada and the uses to which it may be put in the industries has been issued by the Government Printing Office in Canada. It is called Silica in Canada. L. Heber Cole is the author.

Utilizing Waste Rock at Lime Plants

Excessive Waste at Many Lime Kilns. How Small Stone May be Burned Into Lime. Special Uses for Fragments

By Oliver Bowles
Mineral Technologist, Bureau of Mines

MOST of the lime manufactured in the United States is burned in various types of shaft kilns. The fuel and limestone may be added in alternating layers, as in the pot kiln, or the fuel may be burned beneath the stone, the flames and hot gases passing up through the spaces between the rock fragments. In either method it is essential that a strong draft be maintained. In some kilns the natural draft is sufficient, others employ tall stacks, while power fans may be used for forced draft. The necessity for good draft is a great detriment to the utilization of small sized fragments of stone, for if large quantities of the finer materials are mixed with the larger masses the draft is greatly retarded and imperfect calcination results. Stone varying in size from 4 to 10 or 12 in. is employed in most shaft kilns, while rock below 4 in. is either discarded or diverted to other uses.

Excessive Waste at Many Lime Plants

Rock too small for use in shaft kilns together with fragments that are unsuited for lime manufacture constitute a considerable percentage of the total output at many plants. The small-sized stone, though chemically as pure as the high-grade kiln stone, may be difficult to market. Some plants utilize practically all of it in various ways, others use it in part, while at many plants nearly all of the small-sized or otherwise unserviceable rock is discarded as waste.

Year by year the borders of quarries are extended and they are worked at greater depth. With lack of available surface area, the presence of heavy overburden, or the difficulties of working at depth, there is a growing tendency toward underground operations. At several lime-plant quarries visited by the writer during the past summer stopes were being driven from the walls of the open pits. This tendency has a direct bearing on the problem of rock waste, for in general the proportion of fines is higher in underground than in open pit work. With a probable increase in underground work there is a corresponding increase in the necessity for profitable utilization of small-sized stone.

Obviously the cost of lime-plant operation could be considerably reduced if outlets could be found for the waste rock. The purpose of this paper is to consider the various ways in which waste may be used.

Burning Small Stone Into Lime

Many lime-plant operators hesitate to embark on byproduct enterprises because the uses, demand, supply and marketing conditions of the new products are unknown to them. Lime is their primary product and they are familiar with its manufacture and sale. Consequently, it is desirable to consider first of all any possible methods by which a larger proportion of the total rock might be converted into lime.

With this object in view several lime-plant operators have introduced the rotary kiln like that used to burn portland cement. As it requires fine-grained material its employment offers a ready means of using stone that might otherwise be wasted. However, the rotary kiln is an expensive type of equipment that would scarcely be justified except in connection with large operations. Also, the claim is made that the heat losses are high. It may be assumed, therefore, that the rotary kiln is not yet established as a practical means of burning lime.

The Mount kiln, a type of continuous shaft kiln, is finding successful use in burning stone in sizes 3 to 5 in. For large lime plants operating 20 to 24 shaft kilns, the addition of one Mount kiln for small fragments and one rotary kiln for fines is regarded by some as an ideal equipment that will utilize practically the entire quarry output. Such a balanced equipment is highly desirable for it enables the operator to turn practically his entire raw material into lime, a more desirable plan than to manufacture lime together with a series of other products. Small operators cannot of course operate such types of kilns, and much of the smaller rock they produce must be wasted or diverted to other uses.

It is probable that with some modification in the construction of the modern shaft kiln and with a careful grading of the stone according to size, fragments much smaller than 4 in. could be calcined successfully. The Bureau of Mines is giving consideration to this problem at the present time, but the inquiry is by no means complete. The co-operation of lime manufacturers in conducting experiments of this character is greatly desired and the bureau stands ready to discuss the problem in detail with any lime manufacturers that are interested.

Waste Used for Fluxing Stone

Fluxing limestone is usually prepared in sizes ranging from 2 to 7 in. Open-hearth steel furnaces usually demand stone not less than 4 or 5 in. in size, but for blast furnaces smaller stone may be used. Smelting companies that operate their own fluxing quarries may use stone as small as ¾ in. mixed in with the larger sizes, but where purchases are made from independent producers it is unlikely that sizes smaller than 2 in. would be acceptable. Thus 2- to 4-in. stone might be sold to blast furnaces in limited quantities, though a large amount of the small-sized stone would be undesirable when not mixed with the larger sizes. This use is limited not only by the demand but by transportation, for it is too low priced to justify a heavy haulage charge. Most limestone used for lime manufacture is well adapted chemically for fluxing uses, and a number of lime companies sell fluxing stone.

Road Stone

Small-sized limestone, or fragments unsuited for lime manufacture, are used extensively for road building. In districts where road stone is widely distributed and plentiful, it commands so low a price that lime plants can sell it only in limited quantities in local territory. However, some road-building projects are undertaken in regions where rock is not easily obtainable, and instances have been noted where the necessary supplies of small-sized stone have been purchased at lime plants many miles distant, even involving a combined rail and water haul. It is possible, therefore, through enterprising salesmanship to develop a wider market for waste as road stone than that which now exists.

Ballast, Riprap, Etc.

For the maintenance of a good road bed a continuous supply of crushed stone is required on railroad lines. Some railroads operate quarries, but most of them purchase the necessary stone from quarries situated along their lines. With care in preparing a clean stone graded closely in accordance with specifications many operators may build up a steady market for ballast rock.

Large fragments of rock unsuited for lime manufacture may be used for riprap for river or harbor work such as spillways at dams, shore protection or dock construc-

tion. Waste fragments are also used to fill in roadways and yards or for rough wall stone. Such applications are of local significance only.

Concrete Aggregate

Tremendous quantities of crushed stone are now used for concrete aggregate both in highway construction and in the building industries. Limestone makes a good aggregate and is widely used. Only those quarries that are within reasonable distance of building operations may take advantage of this outlet, but, as with road-stone, aggressive salesmanship may often broaden the market greatly. The manufacture of crushed stone on a large scale is commonly conducted in conjunction with lime manufacture.

Special Uses for Small Fragments

Dense compact limestones of attractive color may be crushed into fragments for terrazzo floors. Marbles and certain silicate rocks are used widely in this type of flooring, but there is a demand also for a good quality of limestone.

Limestone chips may be used for facing concrete blocks to give a rock surface effect. Small limestone fragments of good color and reasonably impervious to moisture find some use in stucco and pebble-dash work.

Fine Aggregate

Limestone crushed to the consistency of sand grains may be used as a substitute for sand in mortar and wall plaster. Its superiority over clean sharp silica sand is doubtful, but in regions where natural sand is scarce the substitution of a limestone product may be justified.

Limestone screenings are used with success as fine aggregate in concrete for various purposes. Concrete brick, both common and face brick, are manufactured with limestone screenings as aggregate and are said to give satisfactory service in house construction. Limestone screenings without a binder are used for station platforms, the loose nature affording good drainage while a firm compact surface is formed by the footsteps of travelers and the wheels of baggage trucks. Limestones crushed to granular form and screened to uniform sizes may be sold as chicken grit. The term is a general one, for the products included may be graded by size as turkey grit, pigeon grit, etc.

Agricultural Limestone

Pulverized limestone is widely used for liming the land. There is some question as to the desirability of using pulverized limestone as a substitute for lime on the land, but where there is a demand for it the lime-plant operator may utilize this outlet for materials that would otherwise be wasted.

The demand for agricultural limestone is seasonal, being confined largely to the spring and fall. In order to overcome the disadvantages of this fluctuating demand it is desirable to have a large storage space so that the pulverized product may be continuously prepared from waste and held in stock for the rush seasons.

Filler and Whiting Substitute

Limestone pulverized to a much finer grained form than for agricultural use is finding wide application in various products. Small quantities may be added to stock food as a bone builder. A dust approximately 80 per cent of which will pass a 200-mesh screen is the most widely used filler in road asphalt surface mixtures, though slate flour and portland cement and hydrated lime are used to some extent. Ground limestone is used to a limited extent as a fertilizer filler. It has the advantage over inert fillers in that it has valuable properties as a soil conditioner.

Very finely pulverized limestone may be used successfully as a whiting substitute in certain classes of rubber, paint and other products. It is essential for such uses that it be very finely ground and uniformly sized so as to exclude all comparatively large-sized grains. In general, a limestone flour that will successfully meet the requirements of fillers of a type like whiting or china clay should approximate 300-mesh size. Few lime-plant quarries have the equipment for grinding or sizing to this degree of fineness, and, therefore, have not been able to utilize this promising field of application.

J. E. Carroll Sand Co. to Build 2000-Ton Plant

THE J. E. Carroll Sand Co., with offices at 915 White building, Buffalo, N. Y., has acquired the property known as the Franklinville Gravel Pit from the Pennsylvania railroad, and is now preparing plans for a modern up-to-date washing plant, with an initial capacity of 2000 tons per day.

The location of this new plant is on the Pennsylvania road, 46 miles south of Buffalo, and about the same distance north of the Pennsylvania state line.

This deposit of gravel and sand is one of the best in western New York, running about 50 per cent gravel and 50 per cent sharp, coarse sand. There is an abundance of water underlying the property at a depth of 12 ft. The territory that will be served by this plant covers practically western New York and northwestern Pennsylvania.

J. E. Carroll, president of the company, is of the opinion that the time is coming very soon when New York state and Pennsylvania will abandon its policy of using nothing but crushed stone in the construction of their highways. These two states will eventually have to fall in line with the states of the Middle West, and use a clean, washed gravel in building their highways.

The use of clean, washed gravel in making concrete has an economic interest which must be considered by the highway departments of both states.

Mr. Carroll intends to visit Ohio, Indiana, Michigan and Illinois on an inspection tour of the newest and latest plants, to acquire the latest ideas developed in this line of business. He expects to have the plant in operation by April 1, 1924.

250 Bid on Missouri Road Contracts

NEARLY 250 contractors submitted bids Sept. 5 for road improvements, amounting to approximately $2,000,000. Bids for supplying the state with sand, gravel and rock for road improvements, covering a period of five years, were also submitted.

The crowd was too great for the hearing room of the commission, and adjournment was taken to the Senate Chamber, where Chief Engineer B. H. Piepmeier read off each bid in the order in which it was received. There were 231 bids received for the grading of 108 miles of highway in 26 counties and 22 miles of hard-surfaced roads and 15 bids for supplying the state with sand, gravel and rock for five years.

The latter is a new venture. It is estimated that 4,000,000 tons of sand and gravel and 1,000,000 tons of rock will be required during the five years. The state has been paying as high as $1.75 per ton at the quarry for rock. One contractor today offered to supply the needs of the department for the entire state with rock at $1.20 a ton at the quarry. Enigneers of the commission said that it would require at least one week to make awards for sand, gravel and rock. The cost of shipments from points of loading will first have to be ascertained before any of these bids can be awarded. Some of the bids for supplying a part of the state with sand, gravel and rock range from as low as 35 and 40 cents a ton for sand and gravel and 90 cents for rock.

The counties in which highway improvements are to be made follow: Atchison, Buchanan, De Kalb, Holt, Worth, Livingston, Mercer, Putnam, Marion, Carroll, Cass, Jackson, Ray, Howard, Miller, Osage, Gasconade, St. Louis, Barry, Bates, Newton, Taney, Douglas, Texas, Mississippi and Madison.—*St. Louis Globe-Democrat.*

August Construction Dropped Five Per Cent

THE Dodge Corporation's review of building activities which is issued to many publications and considered authoritative, says that August construction was only 5 per cent below July construction this year. But there is a drop of 15 per cent from August, 1922, in the 27 states in which records are kept. Contemplated work shows a drop of 20 per cent from the amount reported in July. The greatest drop in contemplated work (39 per cent) is in New York state, New Jersey and the Pittsburgh district. The drop in the Middle West was 8 per cent and in the Southeastern states 11 per cent. The other districts show an increase.

Sil-O-Cel Has Been Insulating Lime Kilns for 15 Years

(A Correction)

IN your story on the Western Lime and Cement Co.'s plant at Green Bay, Wis., in the September 8 issue of ROCK PRODUCTS, we note you have shown a photograph of Sil-O-Cel insulation being installed in a shaft lime kiln. Under this photograph you state, "These are the first shaft lime kilns to be so insulated—a step forward for the lime industry."

We wish to call your attention to the fact that there have been lime kilns insulated with Sil-O-Cel for approximately 15 years. There are probably in the neighborhood of 100 kilns insulated with Sil-O-Cel at this time, so that the use of this material for lime kiln insulation has long since passed the experimental stage.

Richard K. Meade has been using Sil-O-Cel for several years as standard construction in the kilns he builds. We are also listing below a few of the plants which have been using Sil-O-Cel for a considerable length of time.

Kimbleton Lime Co., Kerns, Va.
Marblehead Lime Co., Marblehead, Ill.
Merion Lime and Stone Co., Merion, Pa.
National Carbide Co., Ivanhoe, Va.
Nevada Lime and Cement Co., Sloan, Nevada.
Pacific Lime and Plaster Co., Sonora, Calif.
Warner, Co., Chas., Cedar Hollow Plant, Devault, Pa.
Western Lime Co., Denver, Colo.

Sil-O-Cel is also being used in rotary lime kilns and in a large number of rotary cement kilns.

Yours very truly,
CELITE PRODUCTS CO.,
E. A. PHOENIX,
Engineering Department.

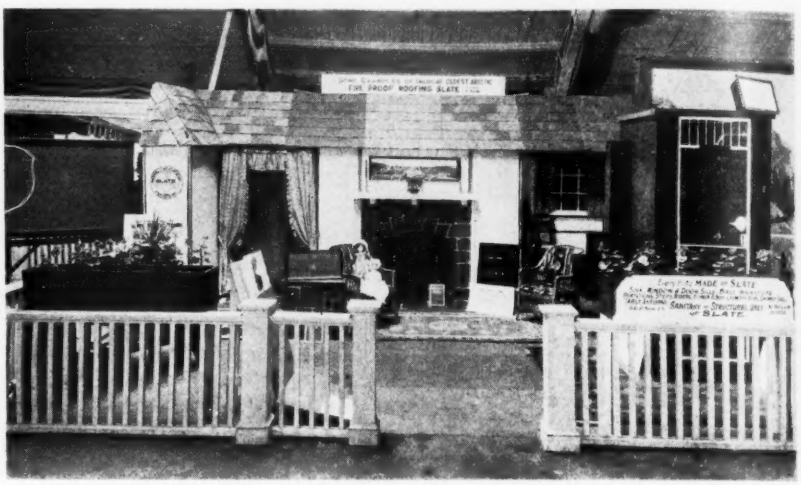
New Glass Plant for Arkansas

THE very rich and extensive glass-sand deposits of Arkansas are to be developed on a large scale, according to recent advices from Monroe, Ark. We are informed that a contract for the construction of a large glass manufacturing plant on a 40-acre site south of Monroe, near the Louisiana Training Institute property, will be awarded by the Owens Bottle Co., of Toledo, Ohio, during the first part of October.

The plant, which will cost $500,000, or possibly more, will be completed by spring. The site was purchased in July by J. B. Graham, trustee, representing the bottle company, from Joseph Biedenharn, of Monroe, and others.

Liquid Oxygen Explosives

E. D. GARDNER, mining engineer of the Bureau of Mines, Department of the Interior, has recently spent several weeks in the vicinity of Denver, Colo., conducting tests with liquid oxygen explosives in cooperation with an industrial concern. Besides making field tests, considerable work has been done toward developing a new low-cost cartridge as a carrier for the liquid oxygen.



This photo shows the very handsome exhibit made by the National Slate Association at the House Beautiful Exhibition recently held at Atlantic City, N. J. It surprised many who saw it to learn how many articles which enter into the building and furnishing of a home are made of slate

(International Newsreel Photo)

This blast for which 60,000 lb. of dynamite were fired, broke down 250,000 tons of rock, enough to last the quarry at Frazier, W. Va., for a year. One of the holes was 150 ft. deep

Questions and Answers

Cummer Process of Calcining Gypsum. Cyrus Field Willard writes concerning the increase of volume of gypsum ground after calcination:

In reading the article on the Cummer process of calcining gypsum in the June 30 issue, I noticed that the writer wonders why gypsum, ground after calcination, is more bulky than gypsum ground before calcination, as by the kettle process, when both products are ground to the same degree of fineness and says it seems to be unexplained, at least no theory is known to that writer which explains it.

If this be so, it may perhaps be attributable to some of the facts which are explained by colloid chemistry where an adsorption (not absorption) of gases on solids takes place. While not directly asserting it is so, it is possible that the bulkiness is due to adsorbed air where the calcined particles when cooled take on or adsorb a small film of air around each particle so as to materially increase the bulk of the aggregate of the particles. The reverse action may take place in the other case.

It is the occluded air which causes the difference.

The kettle burners can have the same bulk package as the other if they want it at practically no expense.

No. 86. **Water Used in Screening**—I have been advised that the more water that is used in screening sand and gravel the better the screen will work and the greater the tonnage that the screen will pass. Is there any limit to this? What is the usual practice as to the amount of water used in screening sand and gravel?—J. B. C.

Up to a certain point, the increase of water increases the efficiency of the screen and the tonnage that may be passed. The writer does not know of any tests that have been made to determine at just what proportion of water to solids the increase ceases. The old rule for the use of water in washing sand and gravel is that 1 gal. per minute should be used for each yard of sand and gravel washed per day. This figures out to a ratio of 1½ water to 1 of solids. But this would only do for bank material that contained considerable coarse stuff. Coarse screens require much less water than fine. A common ratio to find in well run plants is 2 of water to 1 of sand and gravel. If the gravel is taken out first, this leaves a dilute mixture to be screened by the fine screens, where more water is needed. The only definite figures the writer can find are those given by the General Engineering Co., of Salt Lake City, for the use of water with Callow (belt) screens. This company states that 3½ times the weight of water should accompany the sand to be screened; that less water is not enough and more water does no good. These screens are used only on fine stuff, from 3½ mm. down to 100-mesh.—E. S.

No. 87. **Concrete Bins for Hydrated Lime.**—We propose building concrete bins for storage of hydrated lime. Will you be good enough to tell us if there would be any difficulty in removing the material after it had been in the bins for several months?—H. C. B.

A. We do not believe that you will have any serious difficulty in recovering the material from the bins after storage. Should any difficulty arise, you will find that by inserting a jet or two of compressed air into the bottom of the bin you can easily loosen the material so that it will flow to the discharge spouts. This is quite a common practice.—N. C. R.

No. 88. **What Is Whinstone?** One of our correspondents has sent in an inquiry in which the word "whinstone" is used. What is the American equivalent of this word?—T. S.

A. "Whinstone" is given in the Century Dictionary as a local name applied in the north of England and in Wales to hard, close grained rocks. Basalt, trap and hard quartzose sandstone are given in examples. "Whin" is also used in this sense.—E. S.

No. 89. **Booster and Relay Pumps**—What is the difference between a booster pump and a relay pump, and what are the advantages of using more than one pump anyway?—H. D.

A. The difference between a booster and a relay pump is that the booster pump is put into the discharge line of the primary pump and the relay pump is a separate unit. In using a relay pump the primary pump discharges into a sump or a pool from which the relay pump takes it. Each system has its advantages and its advocates. The big dredge contractors who dig from the bottoms of rivers and harbors and deposit the dirt at long distances from the dredge (often more than a mile) generally prefer to use a booster pump. It is claimed that this takes less power than the relay pump, because there is no loss of entry head or hydraulic head. Entry head is the force that is used (measured in feet depth of water) to make the water and sand flow into the suction of a pump, and hydraulic head is the head that is required to keep the water *moving* in the pipe line. The primary pump has already supplied these to the stream in the pipe line so the booster pump does not have to do more than overcome the static head, or lift, and the friction in the pipe line. While this may be true, the relay pump has advantages of its own, especially in dredging sand and gravel. In most cases the percentage of solids discharged by the primary dredge pump is not high; it often figures as low as 6 or 7 per cent. The relay pump can pump a thicker mixture, 15 or 16 per cent, by putting in some dewatering arrangement to handle the discharge of the dredge pump and thus save a great deal of power. It takes very much less power per ton of sand to pump at 15 per cent solids instead of 6 per cent. And there is a further advantage in that the pumps are separate units. As to the reasons for using booster pumps or relay pumps these are two. The first is that the lift is too much for a single pump and the second is that the single pump cannot give sufficient velocity to the material in the pipe line to keep the coarser particles from falling to the bottom and being dragged along on the pipe. A velocity of 12 ft. per second is about as low as can be safely used with coarse gravel and rock although 6 or 7 ft. per second may be used with sand. Practically the booster pump should be used whenever the total lift, including friction, exceeds 150 ft. A good dredge pump will pump against a greater head than this, but it is better to use the booster or relay than to try to force it beyond its economic limit. The subject of dredging by centrifugal pumps is not yet thoroughly treated by any writer so there is no book to which we can refer you.—E. S.

No. 90. **Uses of Silica Sand**—Please give me the uses of silica sand, especially of 80-mesh fine white sand.—H. L. D.

A.—In reply to your question as to the uses of silica sand, there are so many and varied that they could hardly be given in this space. The commonest use, of course, is that of making glass, but a very large quantity is used as steel foundry sand. Minor uses, which require the sand to be carefully sized, are for sand blasting and filters and abrasives. Chemical products, such as water glass, take a considerable amount. As building material, we have such uses as brick making, paint filler roofing material and asbestos shingles. When the sand is very finely ground it is used in making pottery, as a filler in rubber and soap and in silica ware. The 80-mesh sand you speak of could be used for several of the above listed purposes. There is a market in the Eastern part of the United States for such sand for making a special sort of silica brick.—E. S.

Hints and Helps for Superintendents

Photo taken at the Western Lime and Cement Co.'s quarry at High Cliff, Wis., showing how the face looked before the blast

This photo, taken after the blast, shows how a section of the face was moved horizontally without breaking

A Blasting Problem

A GOOD example of the many problems of the plant superintendent and quarry foreman is illustrated herewith. Blasting results do not always follow calculations and judgment and "horse sense" are sometimes worth more than technical knowledge.

The floor of the quarry illustrated is so smooth that it is obvious it was once the bottom of a lake or river, and that a considerable period of time elapsed between the depositions of the two adjacent strata of limestone.

The height of the face is about 20 ft. What happens when a little too heavy a charge of explosive is put in the bottoms of the drill holes is shown in the accompanying views. A whole section of the face was moved horizontally from 50 to 100 ft. The accepted method of blasting is to load the holes heavily at the bottom, but in this case it is evident that the rule must be changed.

Considering the Power Plant

UP to the present time far too little thought has been given by the management of such industries concerning their power plants. In many of the industries where much steam is needed, the power plant has in the past been thought of only as a necessary evil, and little consideration has been given to it by the management except at times when for some reason the power plant fails to perform its function and as a result the production of the mill is stopped. Usually at such times the management is none too complimentary in the remarks or criticisms of the power plant and the men operating the same. These power plants are, as a matter of fact, the heart of the industry, for when the power plant is forced to shut down the rest of the plant is about ready to do the same. The management of any industry should realize that the power plant in that industry is one of its several important departments, which should be given just as much consideration as to its design, equipment, and operation as any other department in that industry. Such a position is the only sane one for a management to take, because when the power plant as a department of the industry is properly designed and equipped and properly operated, it does its share along with the other departments in turning out a product at the lowest possible cost.—W. H. Woods in *Industrial and Chemical Engineering.*

Badly Laid Steam Lines

IT is common practice in the layout of industrial plants to run steam lines haphazard and to cut in with branch tees wherever they are needed. The result is that the pressure drop between the departments where the steam is used and the boiler house where it is made gradually becomes larger as the plant grows in size. The line and condensation losses increase. Fortunate, indeed, is the plant with a master mechanic whose vision carries him beyond today into tomorrow and who plans his piping to meet the future growth of the plant.

In many cases poorly designed steam lines cause excessive vibration. This is especially the case in main steam lines where large volumes of steam traveling at high velocities, must make sharp right-angled turns. Such vibrations cause a gradual weakening of the joints and of the pipe supports and result in unnecessary maintenance and repair costs. Sometimes the installation of a large receiver reservoir in a steam line will act as a cushion to absorb the vibration and nullify the ill effects that would otherwise be produced.—*Industry Illustrated.*

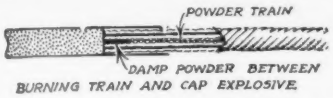
This department will always be glad to receive anything for this page, either photographs or text. Contributions will be paid for if used.—Editor.

Do's and Don'ts When Crimping a Blasting Cap

THE following is an authoritative statement prepared by Arthur LaMotte, manager of the technical bureau of the E. I. Du Pont De Nemours Co., Wilmington, Del., for users of explosives. The statement says:

Did you ever consider that there is a right way and a wrong way to crimp a blasting cap on a piece of fuse? For instance:

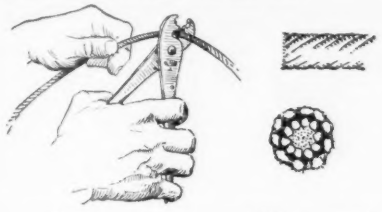
DON'T crimp a cap on a piece of fuse, the ends of which have been exposed to damp air, until you have cut off and discarded about an inch of the fuse. The powder core takes up moisture at the end and this damp powder refuses to burn, so that the spark from the powder train never reaches the explosive in the cap.

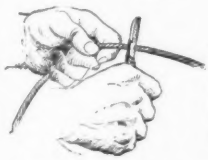


Cut off a single length of fuse at least long enough to reach 2 or 3 in. beyond the collar of the bore hole, and crimp the cap on the freshly-cut end. The use of "short fuse" or "skin-'em-backs" is prohibited by law in some states. It is not only dangerous but also wasteful because you cannot tamp the hole effectively and so do not get full execution from the explosive.

DON'T cut the fuse with a dull, dirty knife or a hatchet. It is always sure to smear some of the waterproofing in the fuse across the powder train like this:

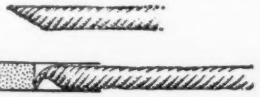
Use a du Pont cap crimper to cut the fuse as it makes a straight cut like this:

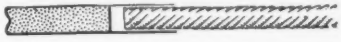




DON'T cut the fuse at an angle like this. The pointed end is likely to bend over and cause a misfire.

DON'T leave an air space between the end of the fuse and the fulminate in the cap as this may prevent the spark of the fuse from igniting the fulminate in the cap.





DON'T crimp the blasting cap with your teeth. Men have been killed doing this. Even if you are not killed, it does not make a good, tight crimp.

If you use a knife, keep it sharp and clean and cut the fuse straight across, as shown below.

Slip the cap over the end of the fuse until the fulminate in the cap touches the end of the fuse.

Hold the cap and fuse in this position and then crimp the cap as near as possible to the open end with a du Pont cap crimper.

If everyone will make up primers as approved, and avoid the practices condemned, better results from blasting with cap and fuse will be secured.

The pipes bring compressed air to the sides of the bin. The air loosens up the lime and keeps it flowing to the sacker

Compressed Air for Loosening Hydrated Lime

THE view herewith shows an installation of compressed-air jets on one side of the bottom of a V-shaped bin for hydrated lime, which feed a Bates valve-bag sacker. Both sides of the bin are similarly equipped.

In handling very fine materials like hydrated lime, portland cement and pulverized limestone, plant superintendents frequently have difficulty from the material packing in bins and not flowing freely.

The thing that makes these fine materials flow is a coating of air, which keeps the individual particles apart. When allowed to settle or pack, the air is pressed out and any material, under these conditions, becomes so solid that it will stand in an almost vertical wall.

The obvious way to make it flow again is to introduce air, which will spread out and again surround each individual particle and so "lubricate" them that they will slip on each other and thus the material flows.

That is the object of such installations as those shown. The more jets of air opening into the bin, the quicker the action of the air, of course, in loosening and lubricating the material within. The pressure should be a little more than the pressure of the material against the inside of the bin, so that the air will force its way up into the material.

There is nothing new about this use of compressed air. We mentioned a similar installation at a limestone plant in Buffalo several years ago, and it is believed that the device originated in the cement industry from experience in handling bulk cement shipments on the Great Lakes. But the view herewith, taken at one of the lime plants of the Western Lime and Cement Co., in Wisconsin, is an unusually good illustration of its application.

Compressed air has been introduced into sand storage piles to make the sand flow through a gate to a belt conveyor in a tunnel below the pile. The same method has also been applied in handling ground phosphate rock.

Rock Products Literature

Concrete in the Country

HOW TO USE CEMENT FOR CONCRETE CONSTRUCTION, FOR TOWN AND FARM. By H. Colin Campbell, C. E., Director Editorial and Advertising Bureau of the Portland Cement Association. Cloth, 380 pp., with many photographs and drawings. The Stanton & Van Vliet Co. Chicago. $2.00.

THIS is a book which will interest all readers of ROCK PRODUCTS, the producers of sand, gravel and stone as well as the manufacturers of cement. It treats in a simple way of the construction of concrete structures on the farm and in the country town, where the work is not done under the supervision of a skilled engineer but usually by the owner of the place and such labor as he can hire locally. It is as simple and elementary as it needs to be, for it could not be a treatise on concrete engineering and appeal to the class of readers for which it is intended. But it is written in good, clear English and the drawings are of the sort that anyone can comprehend, even though he does not know how to read a blueprint. Mr. Campbell's position and reputation as an engineer are a sufficient guarantee of the reliability of the instructions given and the accuracy of the information imparted.

The introductory chapter is a strong argument for "farming with concrete." The writer shows that the use of such a material is essential if the farm is to be conducted in accordance with modern ideas of sanitation and efficiency. The book then takes up concrete materials and their mixing. One notes with satisfaction that the author points out that "the most serious mistake that can be made is to think that ordinary sand and pebble mixture, such as are found in a gravel bank on a farm, will make good concrete." He shows that it must be clean and graded. One might wish that he had given more on the characteristics of good concrete aggregate since the matter is of so much importance.

However, he has given an excellent discussion of the relation of voids in the aggregate to the strength of the concrete, and also to that most important matter, the amount of water to be used. He also explains the use of reinforcing in a simple way, with a number of simple diagrams. Forming is very well treated with a great many drawings illustrating the principles and their application to certain details. Then passing from the general to the particular, the succeeding chapters discuss the making of Foundations and Walls, Tanks, Troughs, Cisterns, Floors and Pavements, Tennis Courts, Barns, Poultry Houses, Silos, Machine Sheds, and the various smaller structures found about a farm. There is an especially good chapter on the concrete septic tank. The various methods by which concrete may be used are well treated, not only the monolithic form but the precast and block forms. There are excellent chapters on surface finishing, the use of color and stucco work.

Concrete residences, of monolithic, block and precast types, are shown in text and photograph, the author's idea being not so much to teach a man to build his house of concrete as to explain the principles involved and the adaptability of concrete to residential structures.

Anyone at all interested in the making of small concrete structures will do well to read this book, for it is full of information concerning them, and concrete is of constantly growing importance in the country districts. Many a sand and gravel and crushed stone producer would feel the loss keenly if he were cut off from the sale of that part of his product which he classes as "country trade."

Oil Shale

THE OIL SHALE INDUSTRY. By Victor Clifton Alderson, President Colorado School of Mines. Cloth, 175 pp., 15 illustrations. The Frederick A. Stokes Co. New York.

AT the present moment, when petroleum products are selling at a figure which the producers claim is below the cost of production, interest in new sources of gasoline and oil is at a low ebb. But the logic of events is bound to bring it back, for unless all the geologists in the country are mistaken, we are exhausting our oil resources and the opportunities for finding new oil fields are growing less.

Dr. Alderson's book is just the book needed by the man who wishes to post himself on the possibilities of the oil shale industry. It contains an especially good description of the successful Scotch shale industry, including the all important figures of capital invested and dividends paid. It also mentions the French and Australian workings which are at present supported in part by government subsidies.

Perhaps the most valuable part of the book is the description of the work already done in the United States, both experimentally and in a commercial way. This shows that while American shales are quite as good a raw material as any that are found in other countries, they are not to be worked by slavishly following the methods of Scotland and France. New methods and new machinery must be used to comply with the conditions imposed by the cost of labor in this country and the American market for oil products. The American shale industry will be built on large tonnage mining methods, such as are already worked out in the copper and iron mines, and the utmost use of quantity production, labor-saving machinery, such as we have developed in so many American industries. This ought to make it particularly attractive to American capital, as it will be when drilling for oil ceases to be the fascinating gamble that it appears to the public at present. One who has seen metal mining pass through the gambling stage may realize that this day may be nearer at hand than it seems to be now.

Books Received

MINE RESCUE STANDARDS. A tentative study. Prepared by a committee appointed at the International Mine-Rescue Standardization Conference, September, 1921. Technical paper 334, U. S. Bureau of Mines, Washington, D. C. 6x9; 44 pp. Published by the Superintendent of Documents, Government Printing Office, Washington, D. C., price 5c.

ASPHALT AND RELATED BITUMENS. By K. W. Cottrell. Mineral Resources of the United States, 1922—Part II, pp. 7-13; 6x9. Government Printing Office, Washington, D. C.

THE MOTOR GASOLINE SURVEYS OF 1920 AND 1921. By N. A. C. Smith. Technical Paper 328, U. S. Bureau of Mines. 6x9; 42 pp. Published by the Superintendent of Documents, Government Printing Office, Washington, D. C., price 5c per copy.

PROGRESS OF INVESTIGATIONS ON LIQUID-OXYGEN EXPLOSIVES. By S. P. Howell, J. W. Paul, and J. L. Sherrick. Technical Paper 294, U. S. Bureau of Mines. 6x9; 92 pp., illus. Published by the Superintendent of Documents, Government Printing Office, Washington, D. C., price 15c.

SUMMARY REPORT OF THE INVESTIGATION MADE BY MINES BRANCH DURING THE CALENDAR YEAR ENDING DECEMBER 31, 1921. 6x9; 346 pp., illus. Published by the Canada Department of Mines, Ottawa, Ont.

THE COMMERCIAL GRANITES OF NEW ENGLAND. By T. Nelson Dale. Bulletin 738, U. S. Geological Survey. 6x9; 488 pp., illus., published by the Superintendent of Documents, Government Printing Office, Washington, D. C., price 50c.

1923 YEAR BOOK OF THE COMMERCIAL FERTILIZER. A directory of fertilizer and fertilizer machinery and equipment manufacturers, with editorial material on the fertilizer industry. Contains directory of state agricultural experiment stations and officials in charge of the execution of fertilizer laws. 8x11; 162 pp., illus. Published by Walter W. Brown, Hurt building, Atlanta, Ga. Free to operators.

FARM HELPS FROM EXPERIMENTS. Bulletin No. 181, Agricultural Experiment Station, College of Agriculture, University of Arkansas, Fayetteville, Ark. 6x9; 104 pp., illus. Contains data on agricultural lime, limestone and phosphate.

THE GEOLOGY AND MINERAL RESOURCES OF THE COLLINGSWOOD SUBDIVISION, KARAMEA DIVISION. By M. Ongley and E. O. MacPherson. Bulletin No. 25 (new series), Geological Survey Branch, Department of Mines, New Zealand. W. A. G. Skinner, Government Printer, Wellington, N. Z.

WEIGHTS AND MEASURES. Fifteenth Annual Conference of Representatives from Various States, Held at the Bureau of Standards, Washington, D. C., May 23, 24, 25 and 26, 1922. 7x10; 132 pp. Published by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 15c.

GEOLOGY AND MINERAL RESOURCES OF THE MORRIS QUADRANGLE. By Harold E. Culver. Extract from Bulletin No. 43, State Geological Survey, Department of Registration and Education, State of Illinois. 6¼x10; geology including limestone, sand and gravel.

PREPARATION, TRANSPORTATION AND COMBUSTION OF POWDERED COAL. By John Blizard. Bulletin 217, U. S. Bureau of Mines. 114 pp., illus. Contains chapter on economic Mines. Published through the courtesy of the Canadian Department of Mines. Superintendent of Documents, Government Printing Office, Washington, D. C. Price 50c.

The Ninth National Exposition of Chemical Industries

IN order to stimulate professional interest in the broad field covered by engineering and pure chemistry, the exposition authorities introduced an innovation this year in the form of a short course in the practical problems of the chemical industries.

Under the direction of Dr. Reade, of the Sheffield Scientific School, various phases of the industries were covered by specialists in their lines. The students were limited to those selected by the professors of the various chemical schools—sort of an advanced course. The enrollment was about 125.

Several companies well known to ROCK PRODUCTS readers sent representatives to address the students. The subjects discussed were:

Pulverization of Chemicals, Colors and Dyes—S. B. Kanowitz, Raymond Bros. Impact and Pulverizing Co.

Hammer Mill Pulverizing—Paul Webster, K-B Pulverizer Co.

Crushing and Grinding—Harlowe Hardinge, Hardinge Company.

Screening Problems—Hugh Garvin, The Orville Simpson Co.

The Ruggles-Coles Dryer—F. E. Finch, Ruggles-Coles Eng. Co.

Conveying with Steel Belting—Harry Carlson, Sandvik Steel Co.

General Discussion on Separation of Liquids and Solids—H. N. Spicer, The Dorr Co.

While most of the subject matter pertained to the relationship between the various types of machinery in the chemical field, the general subject matter should be of interest to men who have similar problems in the rock products industries. Although some of these men lectured extemporaneously, those who had notes would perhaps be willing to send copies to any of ROCK PRODUCTS readers.

The exposition itself was naturally confined to the chemical industries, yet in many cases there is a distinct relationship between these industries and those of rock products. Specific evidence of this may be had in the case of lime. The National Lime Association had an excellent exhibition which stimulated considerable interest among manufacturers and laymen in the part lime plays in the production of chemicals.

The National Slate Association also had an exhibition of the various uses to which slate can be put in the chemical field. Slate for laboratory sinks, panels, etc., made a very excellent demonstration of its practicality.

Another aggressive exhibitor was the Southern railway. This company showed samples of well-known rock products found in the territory adjacent to its lines. It was a remarkable exhibition of non-metallic minerals, one well worth seeing. Similar to this exhibition was that of the C. R. R. of Georgia.

Along these same lines the Department of Mines, Ontario, showed specimens of both metallic and non-metallic minerals found in that province.

Other exhibitors familiar to ROCK PRODUCTS readers who showed their equipment to the best advantage were:

Arkell Safety Bag Co., New York City.
Beckley Perforating Co., New Jersey (Garwood).
Clipper Belt Lacing Co., Grand Rapids, Mich.
Dorr Co., New York City.
General Electric Co., Schenectady, N. Y.
B. F. Goodrich Co., Akron, Ohio.
Hardinge Co., New York City.
Magnesia Talc Co., Waterbury, Vt.
Morse Chain Co., Ithaca, N. Y.
Newark Wire Cloth Co., Newark, N. J.
Philadelphia Gear Works, Philadelphia, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Ruggles-Coles Eng. Co., New York City.
Sandvik Steel, Inc., New York City.
Orville-Simpson Co., Cincinnati, Ohio.
Sturtevant, B. F., Co., Hyde Park, Mass.
Sturtevant Mill Co., Boston, Mass.
Tyler, W. S., Co., Cleveland, Ohio.
Westinghouse Elec. and Mfg. Co., East Pittsburgh, Pa.

State Management of Lime Plant Did Not Pay

THE Medford, Ore., *Tribune* prints the following dispatch from Gold Hill, Ore., under date of August 16:

There is a change in the management of the state lime plant at Gold Hill. Toney Ross and Edw. Shoemaker, both Gold Hill men, have been operating the plant the past two years on a contract with the state. Mr. Shoemaker retires and Mr. Ross will continue the management under a recent two-year contract. Much credit is due these men, who have reduced the cost of the finished product to such an extent that the state can keep the plant in operation throughout the year, while under the state management it was impractical to keep the plant in operation at all.

Nazareth Cement Plant's Heavy Fire Loss

ON the night of September 14 a fire started in one of the stockhouses at the Nazareth plant of the Phoenix Portland Cement Co. The fire made rapid headway and before it was extinguished, completely destroyed the bag house, packing room and three stock houses as well as the finishing mill building and part of the contents of the finishing mill. The loss is estimated at approximately $350,000 and is covered by insurance. The origin of the fire is as yet unknown.

Plans are already under way and contracts will be let within the next few days to rebuild everything destroyed with modern fireproof construction. The rebuilding will require approximately five months, and when completed the entire plant will be fireproof throughout. The rest of the mill was not damaged as it is of fireproof construction, and the kilns were started two days after the fire. Arrangements have been made to have clinker ground at neighboring plants.

The company has made arrangements to procure sufficient cement to take care of all its customers without interruption.

Slate Drilling and Broaching

A STUDY of slate drilling and broaching methods will be made by the Department of the Interior at the newly established non-metallic experiment station of the Bureau of Mines at New Brunswick, N. J. The excessive shattering of slate due to the heavy blows of channeling machines has led a few operators to try out experimentally a method of drilling closely spaced holes and broaching out the cores betwen them. Little or no shattering results from this method. It is evident that the method will be successful when properly developed, bat there is need of further experimental work, and the compilation of exact data for comparative purposes. It is proposed to collect all available data on work already done by three companies in the Pennsylvania slate district, and to issue a preliminary report. It is probable that co-operative work to obtain more complete and detailed results may be arranged by the Bureau of Mines within a few months.

Alabama's Minerals

AMONG Alabama products which were exhibited at the recent chemical show were graphite, kaolin, glass sands, lime, limestone, dolomite, mica, calcium arsenate, marble, quartzite, asphalt (from vicinity of Russellville and Hartselle); red, brown and gray iron ore; coke and its by-products, including napthalene, latest by-product industry to begin operation in north Alabama.

Industrial possibilities were elaborated in detail in a series of smaller charts and maps, each of which is devoted to an exposition of a single mineral or industry. These maps showed, for example, the location of graphite, kaolin, glass sands, limestone, dolomite and mica; the extent of Alabama's coal and iron fields and the progress which the state has made in converting these and other raw materials into finished products of commercial value.—*Dixie Manufacturer*.

Traffic and Transportation

By EDWIN BROOKER, Consulting Transportation and Traffic Expert,
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning September 17:

Central Freight Association

7086. Sand, viz.: Blast, engine, finishing, silica, Rush Run, Ohio, to Detroit, Mich. Present, $2.20 per net ton; proposed, $1.89 per net ton.

7087. Crushed Stone, North Baltimore, Ohio, to Beach City, Ohio. Present, $1.30 per net ton; proposed, $1 per net ton.

7108. Crushed Stone, Sullivant and Marble Cliff, Ohio, to Somelville, Collinsville, Seven Mile and Hamilton, Ohio. Present, 16½ cents, except to Hamilton, 16 cents; proposed, $1.10 per net ton.

7120. Sand and Gravel, Strasburg and Beach City, Ohio, to Bowerston, Ohio. Present, $1.40 per net ton; proposed, 90 cents per net ton.

7121. Ashes, Cinders and Slag, Benwood, W. Va., to Pleasant City and Ava, Ohio. Present, 13½ and 14½ cents; proposed, $1.15 per net ton.

7122. Sand and Gravel, Akron, Ohio, to Avon and Shawville, Ohio. Present, $1.20 and 90 cents per net ton; proposed, 80 cents per net ton.

7138. Crude Slag, Ashes and Mill Refuse, Sidings and Furnaces and Mills at New Castle, Pa., within switching limits to sidings at dumping property within New Castle switching limits. Present, 38 cents per net ton; proposed, 30 cents per net ton. The rate, as above proposed, to be published to expire 12 months from date of its issuance.

7140. Refuse Limestone Screenings, Hillsville and Walford, Pa., to Greenock, Pa. Proposed, $1.05 per net ton., minimum weight marked capacity of car, except when loaded to full cubical or visible capacity, actual weight will apply.

Illinois Freight Association

2067. Stone, crushed, C. L., minimum weight capacity of car. To B. & O. R. R. stations, Shattuc, Hury, Caryle and Beckemeyer, Ill., from Lehigh and Kankakee, Ill., $1.13 per net ton; from Thornton, Ill., $1.26 per net ton. (M. R. P. 245.)

2068. Stone, crushed, C. L., minimum weight capacity of car. To T. P. & W. Ry. stations Cheno, Eureka, Washington, Farmdale and Peoria, Ill., from Lehigh and Kankakee, Ill., 88 cents per net ton; from Thornton, Ill., $1.01 per net ton. (M. R. P. 247.)

2081. Sand and Gravel, C. L., to establish commodity rate of 100 cents per net ton of 2000 lb. on sand and gravel. C. L., minimum weight capacity of car, from Lincoln, Ill., and $1.13 per net ton of 2000 lb., from Peoria-Pekin, Ill., to Gilman, Ill.

New England Freight Association

5182. Lime, in bags, Lee, Mass., to Buffalo, N. Y., 20½ cents. Reason—To move the traffic and meet demands of shippers.

Southern Freight Association

11054. Sand and Gravel, C. L., minimum weight 10 per cent less than marked capacity of car, from Prattville Junction and Jackson's Lake, Ala., to Pineapple, Ala. Present rate, 12½ cents. Proposed rate, 6½ cents per 100 lb., made on basis generally used from these points, distance considered, to L. & N. R. R. local stations in contiguous territory; also approximate rates produced by use of proposed Georgia mileage scale for joint haul for distances of 95 and 83 miles.

11060. Cement, C. L., from Birmingham, Ala., and Group to Central of Ga. Ry. local stations in Georgia. Present rates, as published in Agt. Glenn's Cement Tariff, I. C. C. A372. Proposed rates, same as from Leeds, Ala.

11067. Cement, Lime and Plaster, mixed carloads, from River Front Extension, Tenn., to various destinations. At the present time mixed carload rates are published on cement, lime and plaster from Knoxville, Tenn., to various points. In So. Ry. I. C. C. A9110, basis for rates from River Front Extension, Tenn., is published providing for through rates on certain commodities destined to points beyond Knoxville, made arbitraries over the current Knoxville rates, included among these commodities being lime, C. L., through rates made 1½ cents over Knoxville; no basis being provided, however, on mixed carloads of lime, cement and plaster. It is proposed to provide basis for through rates on these commodities in mixed carloads from River Front Extension, Tenn., made 1½ cents per 100 lb. higher than current rate from Knoxville, Tenn.

1107. Crushed Stone, C. L., from Newsom, Tenn., to Greenbrier, Tenn. Present rate, 24½ cents per 100 lb. (Class A). Proposed rate, $1.17 per net ton.

11122. Sand, molding, C. L., minimum weight 60,000 lb., from Pleasure Ridge Park, Ky., to Rockwood, Tenn. Present rate, $3.15 per net ton; proposed rate, $2.25 per net ton, same as to Chattanooga, Tenn.

11153. Slag, C. L., from Birmingham, Ala., and points taking same rates, to Clarksdale and Kosciusko, Miss. Present rate, $6.40 per net ton (Class A); proposed rate, $1.87 per net ton, same as currently in effect from Birmingham to other points on the Y. & M. V. R. R. in the same vicinity.

11162. Molding Sand, C. L., from Ohio River crossings and St. Louis, Mo., and points taking same rates, to Clarksville, Tenn. It is proposed to reduce present rates to be the same as in effect in Nashville, Tenn.

11180. General revision of lime rates between points in Southern territory. The present lime rates between points in Southern territory do not reflect a proper adjustment in and of themselves, or as between competing kilns, with the result that numerous complaints have been filed by shippers and receivers. In response to such complaints the carriers are submitting a general revision of the rates on this commodity. For more detailed information as to the present and proposed rates, bases, etc., this association will, upon request, be glad to furnish interested shippers with the statistical data in its possession.

Southwestern Freight Bureau

9425. Lime. To establish on lime, C. L., minimum weight 30,000 lb., from Gibsonburg and Woodville, Ohio, to Louisiana points named in Item 5664, S. W. L. Trf. 58-N, the same rates as currently published in the item from Martin, Ohio, to same points. Remarks—It is claimed that Gibsonburg and Woodville, Ohio, are entitled to the same basis of rates to points in Louisiana as at present applicable from Martin, Ohio.

9432. Cement. To establish rate of 26 cents per 100 lb. on cement, C. L., minimum weight 50,000 lb., from Ada, Okla., to Memphis, Tenn. Remarks—The proposed change is desired in order to place the rate to Memphis on basis which appears proper with respect to the rates to Ft. Smith and Little Rock, Ark.; also for similar distances from and to other points in Southwestern Freight Bureau territory.

9440. Crushed Stone. To establish rate of 6½ cents per 100 lb. on crushed stone, C. L., from Morris Spur, Tex., and 5½ cents per 100 lb. from Lone Star Spur, Tex., to Rush Springs, Okla. Remarks—It is claimed that a similar adjustment was recently authorized from the points of origin named above to points immediately south of Rush Springs, Okla.

9514. Lime. To establish the following rates in cents per 100 lb. on lime, carloads, minimum weight 30,000 lb., from Ft. Towson, Okla.

To.	Cents.
Ft. Smith, Ark.	11½
Little Rock, Ark.	19
Hot Springs, Ark.	20½
Pine Bluff, Ark.	19
Camden, Ark.	19
Paris, Tex.	12½

Remarks—At present only class rates are available from Ft. Towson, and there is quite a production of lime at Ft. Towson, Okla. It is the desire of the plant located there to reach points in Arkansas to which the distances are considerably less than from Springfield, Mo.

Trunk Line Association

11625. Cement, common, hydraulic, natural or portland, in packages, C. L., minimum weight O. C., from Union Bridge, Md., to Lancaster, Pa., 12½ cents; Williamsport, Pa., 14 cents, and from Hagerstown, Md., to Williamsport, Pa., 14 cents per 100 lb.

11634. Sand, C. L., minimum weight 90 per cent of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Raritan River railroad stations to Harrison, N. J., via R.R.R.R.-P.R.R. and D.L.W.R.R.; also via R.R.R.R.-P.R.R. and Erie R.R., $1.61 per net ton.

11640. Cement, C. L., minimum weight, O. C., Lehigh District to stations on Bush Terminal R. R., 10 cents per 100 lb.

Western Trunk Line

3388. Cement, hydraulic, portland or natural, straight or mixed, C. L., from, to and between W. T. L. territory. Present minimum weight Item 10A, Sup. 8 to W. T. L. Trf. 133C. A1344 reads: "Rates named in this tariff apply on cement, hydraulic, portland or natural, straight or mixed carloads, minimum weight 50,000 lb., except that when marked capacity of car used is less, the actual weight, but not less than 40,000 lb. will apply and except as otherwise provided herein. Note—Orders for cars of less than 50,000 lb. will not be accepted by the carriers." Proposed—That Item 10A be so amended or a separate item be provided to show the following rule applicable to Nebraska state traffic: "Where one car is loaded with two shipments of cement for different stations, both being in the same general direction but no transfer of contents necessary by reason of such loading, in such cases charge should be assessed on the basis of 44,000 lb. minimum on each shipment, provided actual weight is not greater."

3395. Lime, C. L., from Hannibal, Mo., and other Mississippi River points taking the same rates to Brokaw, Wis. Present, class rates; proposed, 21½ cents per 100 lb., minimum 30,000 lb.

3404. Cement, hydraulic, portland or natural, carloads, from Valley Junction, Iowa, to destinations named in W. T. L. Trfs. 132C and 133C. Present, no through rates in effect; proposed, to provide same rates from Valley Junction as applies from Des Moines, Iowa, in W. T. L. Trfs. 132C and 133C. Subject to Combination Tariff. Minimum weight as provided in W. T. L. Trfs. 132C and 133C. I. C. C. A1343 and A1344.

1564E. Crushed Stone, Chatts (lead, zinc or mine refuse) and Stone (rip rap or rubble), C. L., from Jasper, Pipestone, Quartzite, Minn., and Sioux Falls, S. D., to Atlantic, Iowa. Present, no through rate in effect, except from Sioux Falls, 14 cents per 100 lb.; proposed, 12 cents per 100 lb., minimum weight 90 per cent of marked capacity of car, but not less than 50,000 lb.

Bird Gravel Rating

A FINDING of unreasonableness, an award of reparation and an order establishing a rate for the future have been made in No. 14520, Vincent Sanford vs. Pennsylvania, opinion No. 8746, 81 I. C. C. 730-2, as to a third class, any quantity rating on a carload of bird gravel in cartons, cased, from Jersey City, N. J., to Toledo, Ohio. The carload was shipped in April, 1922. At the time the carload in question moved there was a fifth class rate on bird sand in bags, 30,000 minimum, the fifth class rate being 49 cents and the any-quantity 82 cents. The complainant insisted there was no reason for charging a higher any-quantity rate on bird gravel in cartons, cased, than on gravel in bulk, in bags. The commission so found, awarded reparation and required the carriers to establish the fifth class rate not later than October 29.—*The Traffic World.*

Editorial Comment

F. W. Renwick's story in this issue shows us how modern are the industries covered by ROCK PRODUCTS, about as modern as the automobile.

Gravel a Modern Industry

The use of aggregates in plasters and mortars is very old, of course, but the *extensive* use of concrete, which has brought about what someone has called "the new stone age," goes back little more than a quarter century. Mr. Renwick is a man in the prime of life, yet he notes that he was the first to use a steam shovel in excavating gravel and the first to successfully crush gravel to aggregate size. ROCK PRODUCTS takes a great deal of pleasure in passing on to its readers the story of so successful a career, not alone successful in the way in which we too often measure success, but in the keen satisfaction that one must feel in having pioneered and developed a great industry that has made the world a better and a safer place to live in.

One sentence in Mr. Renwick's story which will interest practical sand and gravel men is that in which he says that "the principle of the limestone plant has been demonstrated to be exactly the reverse of the average successful gravel plant," which seems to refer to the system of screening. Whether to take out the fine or the coarse gravel first is, however, a fairly debatable question. It is true that the majority of gravel plants take out the coarsest size in the first screen, but it is equally true that there are quite as successful plants which take out the finest size in the first screen. It is generally conceded that the more popular method gives the higher capacity, but the other method has advantages of its own, and sometimes it pays the designer to take advantage of them. One of the best known designers of plants in the country adheres to the second method.

Which Way to Screen

Super-power was a dream only yesterday. Today Steinmetz and almost every other electrical engineer in the country is indorsing the idea and tomorrow it may become a reality. It seems that not much new construction is needed. Organization and linking up of units already in operation are mainly what is required to inaugurate a system the possibilities of which are so great that the boldest imagination dares not predict the effect upon industry.

Power Costs

The need for a better organization and development of our power systems is well enough exemplified in the price paid for electric power by plants in the rock products industries. To illustrate, within a radius of 500 miles of Chicago there are three producing companies which have paid respectively 1.75, 2.1 and 5.5 cents per kw.-hr. The figures vary slightly from the above at times, of course, according to the season and the current used, but the relation between the prices paid will not vary much, and there is not much difference in the amount of power used by each company. If any reorganization of our power systems will correct such discrepancies as this, we are for it—strong.

It is with considerable gratification that one reads the news from authentic sources that American steel concrete buildings in Tokio withstood the effects of the most disastrous earthquake in history, in which more than 1200 distinct shocks were recorded by seismographs all over the world. There are six of these buildings in Tokio, but the rebuilt Tokio will probably contain more of them than of any other type of large building construction. Reinforced concrete was not in very common use at the time of the San Francisco earthquake, but one's recollection is that a building of this type passed through the quake with little or no damage. American engineers who studied this test strongly advocated the use of reinforced concrete in localities where earthquakes might be expected.

Concrete Resists Earthquake Shock

An increased demand for many things, especially building materials, will result from the Japanese earthquake, but whatever gain we may get from this will be more than balanced by what we have to pay. This country alone is sending $20,000,000 in cash, every dollar of which must be paid for by labor of head and hand. But this is only the beginning. Silk, it is prophesied, will rise 50 per cent in value and lesser increases may be added to tea and other articles we import from Japan. A world which is already straining itself to keep up with the demand in certain lines must pay still higher prices on account of increased consumption. And then there is the matter of insurance on losses carried in companies which do an international business. We must realize that trade and transportation have made the civilized nations into a family, all the members of which have to help the one who suffers a misfortune. It gives one a renewed faith in humanity to see how readily all the peoples of civilization offer aid at such a time as this. And the action of the American naval officers who left to offer aid without waiting for orders exemplifies the kind of American independence of which we all are proud.

Civilization Like a Family

New Machinery and Equipment

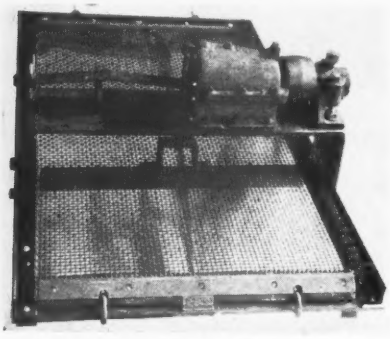
The Leahy No-Blind Vibrating Screen

THE Leahy No-Blind screen is mechanically vibrated, the vibrating mechanism consisting of a hardened tool steel cam, which is engaged by the foot of a hardened tool steel tappet.

The tappet is in turn connected directly to a rigid member under the screen cloth, through a yoke and connecting bolt. A spring end gives the tension necessary to keep the tappet engaged with the cam.

When the cam is rotated, the motion imparted to the screen cloth is differential, as the upward stroke is accomplished after the tappet has jumped off a tooth of the cam and is returning with an accelerated motion to the surface of the cam. The downward motion is accomplished by the foot of the tappet riding the surface of the cam until it again jumps off the tooth of the cam. The accelerated return motion is terminated by an anvil action when the tappet engages the face of the cam again, and this anvil action is responsible for the non-blinding feature of the screen. The quick upward motion of the screen cloth has a tendency to put through particles small and just under the size of the screen opening, and the anvil action finishes up the process by lifting the particles which have not passed through the meshes, free from the screen.

You will note from an inspection of the photograph, that the vibrator is placed about two-thirds the distance down the screen. The material coming on the screen is first affected by a slight vibration and is stratified, the fine material passing to the bottom and through the screen. Farther down the screen, and directly under the vibrator, where the most intense vibration is present, the final cleaning up and close sizing is accomplished unhindered by the presence of fines.



The Leahy No-Blind screen

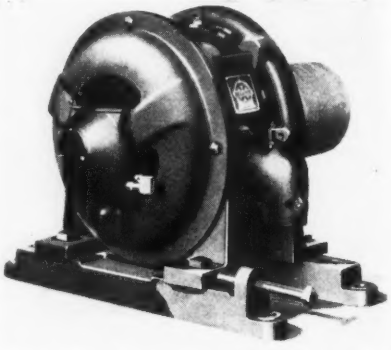
This stratification of the material on the screen and the quick differential vibration imparted to the screen with the anvil action, together with the idea of transmitting the motion positively all the way across the screen cloth, are new features of this machine that are responsible for the high efficiency and exceedingly high capacity this new screen has demonstrated.

Indications are that this new vibrator screen will have a wide application in the rock products fields, and installations thus far made seem to bear out the prediction that it will prove an extremely practical screen for most screening operations.

The screen is made by the Deister Concentrator Co., Ft. Wayne, Ind.

The Reliance Type AA Motor

THE Type AA Reliance Squirrel Cage Motor has been designed not only from the accumulated experience of the engineers of the makers, the Reliance Electric and Engineering Co., Cleveland, Ohio, but from the criticisms and suggestions of 25 engineers in cement mills, stone yards and other industries. After the design was complete, motors were made and placed in operation in 24 plants and kept there for two years to prove their ability to stand up under hard service. The engineers were practically unanimous in picking four things as having the most to do with the continuous and satisfactory operation of squirrel cage motors. These are insulation of stator windings, bearings, rotor construction and high overload torque capacity.



This Reliance motor was designed after a very careful study which included rock products industries

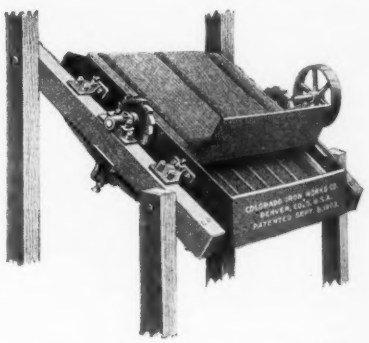
Special treatment of the stator windings in this motor has made them highly resistant to the destructive influences of dirt, moisture, oil, acids and alkalis. The bearing design is so liberal that the bearing pressure is less than 30 lb. per square inch. The rotor, which is the heart of a motor, is specially constructed so that it is practically indestructible at the points which have been the cause of breakdowns with other construction. They have high overload torque capacity and an inverse time limit relay gives protection against burning out due to phase failures. This eliminates all unnecessary interruptions due to temporary and successive overloads.

All the motors are sold under the standard guarantee of the Electric Power Club, protecting the purchaser against any defects which may develop within six months of normal and proper use.

Impact Screen for Wet or Dry Sizing of Materials

FOR ideal results in screening, two conditions should be fulfilled. The finer portion of the material should be brought into actual contact with the screening surface, and the meshes of the screen should be prevented from clogging. The Impact Screen, manufactured by the Colorado Iron Works, Denver, Colo., is claimed to fulfill both of these conditions.

The Impact Screen is carried upon a main frame, upon which the moving parts are mounted. This construction renders the entire machine self-contained and ready to erect by simple attachment to vertical posts. A vibrating frame of wood is flexibly supported within the main frame by a pair of strong elliptical springs, which force it upward against four adjustable stops. Motion is imparted to this vibrating frame by two rachets, operating as multiple cams, keyed to a revolving shaft which carries the driving pulley. The shaft is journaled in bearings carried on the main frame.



The impact screen with housing

The screen frame proper is attached to the vibrating frame in such manner that it can be easily and very quickly removed, for changing the screen cloth, without disturbing any of the other parts.

When used for wet screening, a series of shallow pans is carried by the screen frame just below the surface of the wire cloth and serves to furnish the water necessary to keep the meshes open. The screen frames are interchangeable.

The Impact Screen when used for dry work is provided with a covering housing. This minimizes dusting without in any way interfering with the efficient work of the apparatus. When fine mesh cloth is used, it is of course necessary that the material to be separated should be as dry as possible. With a coarser mesh screen the moisture content may be as high as 6 per cent without adversely affecting the efficiency of separation.

For convenience in replacing the wire cloth when worn, it is fastened by means of strips screwed to a frame provided with slats placed parallel with the travel of the material, and stiffened with a cross piece ½ in. below the screen surface. This frame serves to support the cloth in a true plane, and is fitted in the vibrating frame and held in place by means of thumb screws and clamps, thus permitting its removal and replacement in a few moments without the use of tools. The screen frame and the vibrating frame that carries it are light in weight and constitute the only moving part. There are neither eccentrics nor reciprocating parts to cause trouble and annoyance and involve high repair and renewal costs. The screen is regularly furnished with a steel housing, made with an open top for wet screening and with a wooden top for dry screening.

The motion of the screen is at right angles to the plane of its surface. The effect of the cams is to force the vibrating frame downward against the springs, which, as the cams release, carry the frame upward against the four stroke-adjusting screws, giving the screen a sharp impact. The intensity of vibration being adjustable, by the stroke-adjusting screws, while the machine is in motion, a regulation can be easily secured giving a maximum capacity on any material or grade. A reach rod adjustment is provided to take care of any tilting in the screen frame which could be caused by an excessive change in feed. This adjustment once made for a given feed will not have to be altered.

The motion, impact, gravity, and angle at which the screen is set affects a bed of material passing over the screen in this manner: The particles of the material become graded from fine to coarse, with the fines next to the screen; the impact lifts the bed from the screen for an instant, freeing the screen of all particles tending to clog it. Gravity returns the bed to the cleaned screen with all particles rearranged by the impact, and in position to pass the screen if of proper size.

The Impact Screen is made in two sizes, 3x3 ft., and 3x4 ft., representing the dimensions of the screening surface available. The discharge is conveniently arranged to permit of ready delivery of the product to another screen or to the necessary spouting for conveying away.

The Impact Screen required from ¼ to ½ hp., depending on feed and kind of material. The pulley speed is 50 r.p.m. It is adaptable to screening sand, gravel, lime, limestone, phosphate, gypsum, etc.

A Device for Simplifying the Process of Forging and Heating Drill Steel

A DEVICE known as the Waugh Comparascope, manufactured by the Denver Rock Drill Manufacturing Co., Denver, Colo., has been placed on the market to simplify the rather technical and complex process of forging and heating drill steel and thus to promote efficiency in drilling and insure durability in the steel.

Drill steel, like other steels, having various temperatures, has certain definite colors, and drill steel of a given analysis has a corresponding hardening temperature; hence the problem of finding heat-treatment temperatures is obviously from the blacksmith's standpoint one of color comparison. The Waugh Comparascope is claimed to correctly work out the problem of directly comparing the color of heated drill steel with that of another heated metal having the same color at a given temperature.

The Waugh Comparascope

The body or housing of the comparascope is of heavy metal and designed so that the instrument can be quickly and easily mounted on a wall or a substantial board placed near the furnace. A convenient length of flexible electric light cord is provided with connection for attaching to a nearby light circuit.

A small coil of high resistance wire, visible through a lens, in the center of the apparatus is brought up to the desired heat by merely plugging into the corresponding socket at the left hand side; temperatures, carbon content, and directions being indicated on the directions plate at the right.

The coil has a fixed resistance and is connected in a series with a variable resistance which in turn is connected with the various sockets into which the plug is inserted. A transformer inside the case steps the voltage down from 110 to 220, that of standard lighting circuits, to 30 volts so that shock is eliminated.

A high grade permanent magnet is pivotly suspended at the center of the instrument immediately below the radiating coil. Through an opening, directly above the coil, the magnet indicator shows the non-magnetic condition of the steel. The magnet is not essential to the correct function of the comparascope, but was added as a convenience and serves as an aid at the hardening temperatures only.

There are no parts to get out of order. The resistance, or radiating coil, is good for several months of constant service and can be quickly replaced on the binding post at the back of the lens. The coil is inexpensive, costing only a few cents.

When the carbon content of drill steel is known, forging and hardening temperatures are quickly and easily determinable. This is done by plugging into the socket, having a corresponding carbon content indicated on the directions plate, and heating the steel to the same color as the radiating coil.

If the carbon content is not known, the steel should be tested several times with the magnet. A low red heat is used at first. If the magnet is attracted to the steel, the change point hardening temperature has not been reached. This test is repeated, heating the steel a little more each time until there is no attraction of the magnet. At this point, the color of the steel is matched with the radiating coil by trial plugging into the socket. It is preferable to have the plug in socket "C" 1400 Fahr. when starting test with the magnet, for drill steel having a higher carbon requiring a lower color is seldom used. If socket "C" does not show as high a heat in the coil as there is in the steel, the plug is stepped up to a socket having a higher temperature.

For matched colors as in the manner described above, the carbon content becomes known by the corresponding letter on the directions plate. This testing procedure is not necessary on every piece of drill steel, but only in cases where these kinds of steel have been put in service and there is doubt as to the percentage of carbon.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.25	1.10	1.10	1.10	.....
Buffalo, N. Y.			1.30 per net ton all sizes			
Chaumont, N. Y.	1.00	.....	1.75	1.50	1.50	1.50
Cobleskill, N. Y.	1.25	1.25	1.25	1.25	1.25	.....
Coldwater, N. Y.			1.50 per net ton all sizes			
Eastern Pennsylvania	1.35	1.35	1.45	1.35	1.35	1.35
Munns, N. Y.	1.00	1.40	1.40	1.30	1.30	.....
Prospect, N. Y.	.80	1.40	1.40	1.30	1.30	.....
Walford, Pa.	1.55	1.55	1.55	1.55	1.55	1.55
Watertown, N. Y.	1.00	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill.	1.75	.....	1.50	1.35	.....	.....
Buffalo, Iowa	.90	.....	1.35	1.15	1.20	1.20
Bloomville, Middlepoint, Dunkirk, Bellevue, Ohio	1.00	1.10	1.10	1.00	1.00	1.00
Chasco, Ill.	1.35	1.35	1.35	1.35	1.35	1.00
Chicago, Ill.	.80	1.40	1.10	1.10	1.10	1.10
Dundas, Ont.	.90	1.35	1.35	1.25	1.10	1.10
Greencastle, Ind.	1.25	1.15	1.05	.95	.95	.95
Krause, Columbia and Valmeyer, Ill.	1.20	1.20	1.35	1.35	1.20	1.20
Lannon, Wis.	.80	1.10	1.10	1.00	1.00	.90
Mitchell, Ind.	1.00	1.00	1.00	1.00	1.00	1.00
Montreal, Canada	.90	1.20	1.10	1.00	.95	.95
Montrose, Iowa	.....	1.50	1.60	1.55	1.45	1.40
Sheboygan, Wis.	1.05@1.10	1.05@1.10	1.05@1.10	1.05@1.10	1.05@1.10	1.05@1.10
Southern Illinois	1.35	1.35	1.35	1.35	1.35	1.00
Stolle, Ill. (I. C. R. R.)	1.30	.....	1.35	1.35	1.35	1.35
Stone City, Ia.	.75	.....	1.50	1.40	1.30	.....
Toledo, Ohio	1.60	1.70	1.70	1.70	1.60	1.60
Toronto, Canada	1.90	2.25	1.00	1.00	1.00	1.00
Waukesha, Wis.	1.00	1.00	Prices include 90c freight 1.00	1.00	1.00	1.00
SOUTHERN:						
Alderson, W. Va.	.75	1.25	1.40	1.25	1.15	.....
Bridgeport, Texas	1.10	1.40	1.35	1.35	1.25	1.25
Cartersville, Ga.	.....	1.50	1.50	1.00	1.00	1.00
Chickamauga, Tenn.	.85@1.00	1.00@1.25	.85@1.25	.85@1.25	.85@1.25	.....
El Paso, Texas	1.00	1.00	1.00	1.00	.....	.....
Ft. Springs, W. Va.	.40	1.75	1.75	1.60	1.40	.....
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	.....
Ladds, Ga.	.....	.....	1.40	1.40	1.40	.....
Morris Spur (near Ft. Worth), Tex.	1.10	1.35	1.30	1.25	1.25	1.20
WESTERN:						
Atchison, Kans.	.50	2.10	2.10	2.10	2.10	1.60‡@2.00
Blue Spr'gs and Wymore, Neb.	.20	1.40	1.40	1.35	1.25	1.20
Cape Girardeau, Mo.	1.35	.....	1.10	1.35	1.10	.....
Kansas City, Mo.	1.00	1.65	1.65	1.65	1.65	1.65

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.50	1.35	1.15	1.00	.....
Dresser Jct., Wis.	1.00	2.25	.....	1.75	2.00	.....
Duluth, Minn.	1.00	2.25	2.00	1.50	1.40	.....
E. Summit, N. J.	1.80	2.30	1.90	1.60	1.40	.....
Eastern Massachusetts	.85	1.75	1.75	1.40	1.40	1.40
Eastern New York	.75	1.50	1.50	1.30	1.40	1.30
Eastern Pennsylvania	1.25	1.55	1.50	1.40	1.40	1.40
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60	1.50@2.00	1.35@1.50	1.15@1.25	1.00@1.10	.....
Oakland, Calif.	1.75*	1.75*	1.75*	1.75*	1.75*	1.75*
Richmond, Calif.	.50*	.....	1.50*	1.50*	1.50*	.....
San Diego, Calif.	1.80	1.80	1.50@1.80	1.25@1.55	1.25@1.55	1.10@1.35
Spring Valley, Calif.	.70	1.55	1.50	1.40	1.35	1.35
Springfield, N. J.	2.00	2.20	2.10	1.70	1.70	1.40
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Atlanta, Ga.—Granite	1.47	2.07	2.07	1.97	1.97	.....
Buffalo, N. Y.—Granite	.90	.....	1.20	1.00	1.05	1.10
Berlin, Utley and Red Granite, Wis.	1.60	1.70	1.60	1.50	1.40	.....
Columbia, S. C.—Granite	.50	2.25	2.25	2.00	2.00	2.00
Eastern Penna.—Sandstone	.85	1.60	1.55	1.35	1.35	1.30
Eastern Penna.—Quartzite	1.20	1.35	1.20	1.20	1.20	1.20
Lithonia, Ga.—Granite	.75	1.75	1.75	1.25	1.25	.....
Los Angeles, Calif.	2.00	2.00	1.85	1.75	1.65	.....
Middlebrook, Mo.—Granite	3.50@3.75	.....	2.00@2.25	2.00@2.25	.....	1.25@1.50
Sioux Falls, S. D.—Granite	1.00	1.60	1.55	.....	1.50	.....

*Cubic yd.

Agricultural Limestone

(Pulverized)

Chaumont, N. Y. — Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$ — Thru 100 mesh; sacks, 4.00; bulk 2.50

Grove City, Pa. — Analysis, 94.89% $CaCO_3$, 1.50% $MgCO_3$; 60% thru 100 mesh; 45% thru 200 mesh; 100% thru 20 mesh; sacks, 5.00 ..... 3.50

Hillsville, Pa.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$, 75% thru 100 mesh; sacks, 5.00; bulk 3.50

Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk 2.50

New Castle, Pa.—94% $CaCO_3$, 1.40% $MgCO_3$—75% thru 100 mesh, 94% thru 50 mesh; sacks, 5.00; bulk 3.50

Walford, Pa.—Analysis, 50% thru 100 mesh; 4.50 in paper; bulk 3.00

Watertown, N. Y. — Analysis, 96% $CaCO_3$; .02% $MgCO_3$; 90% thru 100 mesh; bulk, 3.00; sacks 4.50

West Stockbridge, Rockdale, Mass., North Pownal, Vt.—Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 4.75; cloth, 5.25; bulk 3.25

Alton, Ill. — Analysis, 98% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 100 mesh 6.00

Belleville, Ont.—Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk 2.50

Chasco, Ill.—Analysis, 96.12% $CaCO_3$, 2.5% $MgCO_3$; 90% thru 100 mesh 5.00

90% thru 50 mesh 1.35

Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh ..... 1.80@3.80

Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 80-lb p. sacks 5.00; bulk 3.50

Piqua, Ohio—100% thru 10 mesh, 2.10; 50% thru 100 mesh, 2.25; 80% thru 100 mesh, 5.00; 100% thru 100 mesh; bags 7.00; bulk 5.50

Waukesha, Wis.—Analysis, neutralizing equivalent 107.38% $CaCO_3$; 99% thru 10 mesh, 55% thru 60 mesh; bulk 2.35

200-mesh bags ex., returnable 4.50

Hot Springs, N. C.—50% thru 100 mesh; sacks, 4.25; bulk 2.70

Knoxville, Tenn.—80% thru 100 mesh, bulk (bags 1.25 extra) 2.70

Linville Falls, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200 lb. burlap bag, 4.00; bulk 2.75

Mountville, Va. — Analysis, 76.60% $CaCO_3$, 22.83% $MgCO_3$—50% thru 100 mesh; 100% thru 20 mesh; sacks 5.00

Colton Calif.—Analysis, 95% $CaCO_3$, 3% $MgCO_3$—all thru 20 mesh—bulk 4.00

Lemon Cove, Calif.—Analysis, 94.8% $CaCO_3$, 0.42% $MgCO_3$; 60% thru 200 mesh; sacks, 5.25; bulk 4.50

Dundas, Ont. — Analysis, 53.80% $CaCO_3$, 43.31% $MgCO_3$—35% thru 100 mesh; 50% thru 50 mesh; 100% thru 10 mesh; bagged, 4.75; bulk 3.00

Agricultural Limestone

(Crushed)

Alton, Ill. — Analysis, 98% $CaCO_3$, 0.1% $MgCO_3$; 90% thru 50 mesh 1.50

Bellevue, Ohio — Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; ¼ in. to dust, about 20% thru 100 mesh 1.25

Bettendorf, Iowa, and Moline, Ill.—97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh 1.50

Buffalo, Iowa—90% thru 4 mesh 1.00

Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; 100% thru 10 mesh, 90% thru 50 mesh 1.50

Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$; 90% thru 4 mesh ..... .80

Columbia, Ill., near East St. Louis—½-in. down ..... 1.25@ 1.80

Elmhurst, Ill.—Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$; 50% thru 50 mesh 1.25

Huntington and Bluffton, Ind.—Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; about 20% thru 100 mesh 1.25

(Continued on next page)

Agricultural Limestone

(Continued from preceding page)

Greencastle, Indiana.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh..... 2.00
Kansas City, Mo.—50% thru 100 mesh 1.25
Krause and Columbia, Ill.—Analysis, 90% $CaCO_3$, 90% thru 4 mesh..... 1.20
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh..... 2.00
Screenings (¼ in. to dust)..... 1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 100% thru 4 mesh; 83% thru 10 mesh; bulk 1.25
Milltown, Indiana.—Analysis, 94.41% $CaCO_3$, 2.95% $MgCO_3$; 35% thru 50 mesh..... 1.40@ 1.65
Mitchell, Ind.—Analysis, 97% $CaCO_3$, 1% $MgCO_3$; 50% thru 100 mesh, 90% thru 4 mesh..... 1.25
Montrose, Iowa.—90% thru 100 mesh.. 1.25
Narlo, Ohio.—Analysis, 56% $CaCO_3$, 43% $MgCO_3$; limestone screenings, 37% thru 100 mesh, 55% thru 50 mesh, 100% thru 4 mesh..... 1.50@ 2.00
Ohio (different points), 20% thru 100 mesh, bulk..... 1.25@ 1.50
Piqua, Ohio—100% thru 4 mesh..... 1.25
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk..... .80@ 1.40
Stolle, Ill., near East St. Louis on I. C. R. R.—Thru ½-in. mesh..... 1.30
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh..... .75
Toledo, Ohio.—¼ in. to dust, 30% thru 100 mesh..... 1.50
Waukesha, Wis.—No. 1 kiln dried..... 2.00
No. 2 Natural..... 1.75
Alderson, W. Va. — Analysis, 90½ $CaCO_3$; 90% thru 50 mesh..... 1.75
Claremont, Va.—Analysis, 92% $CaCO_3$, 2% $MgCO_3$; 90% thru 50 mesh..... 3.00
50% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh..... 2.75
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh..... 1.50
Ladds, Ga. — Analysis, 56% $CaCO_3$, 42% $MgCO_3$—all passing 10 mesh.. 1.50@ 1.75
Garnett, Okla.—Analysis, 80% $CaCO_3$, 3% $MgCO_3$; 50% thru 50 mesh..... .50
Kansas City, Mo., Corrigan Siding—50% thru 100 mesh; bulk..... 1.80
Tulsa, Okla.—90% thru 4 mesh..... .50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

Glass Sand:

Berkeley Springs, W. Va..... 2.25@ 2.50
Cedarville and South Vineland, N. J.—Damp, 1.75; dry..... 2.25
Cheshire, Mass.—24 mesh, 5.00; 40 mesh, 6.00; 100 mesh..... 7.00
Columbus, Ohio..... 1.50@ 2.00
Dunbar, Pa.—Damp..... 2.50
Falls Creek, Pa..... 2.25
Hancock, Md.—Damp, 1.50; dry..... 2.00
Klondike and Pacific, Mo..... 2.00@ 2.50
Mapleton, Pa..... 2.25@ 2.50
Mapleton Depot, Pa..... 2.50
Massillon, Ohio..... 3.00
Michigan City, Ind..... .50
Millville, N. J. (green)..... 2.00
Mineral Ridge, Ohio..... 2.50@ 3.00
Montoursville, Pa..... 2.00
Oregon, Ill..... 2.50
Ottawa, Ill..... 1.50
Pittsburgh, Pa.—Dry, 4.00; damp..... 3.00
Ridgway, Pa..... 2.50
Rockwood, Mich..... 2.50@ 2.75
Round Top, Md..... 2.75
Sands, Pa..... 2.50
San Francisco, Calif..... 3.00@ 3.50
St. Louis, Mo..... 2.50@ 3.00
St. Mary's, Pa..... 2.25
Thayers, Pa..... 2.25@ 2.50
Utica, Ill..... 1.40@ 1.50
Zanesville, Ohio..... 2.00@ 2.50

Foundry Sand:

Albany, N. Y.—Core..... 1.25@ 2.00
Furnace lining, molding fine, molding coarse, brass molding..... 2.00
Sand blast..... 2.50@ 4.50
Allentown, Pa.—Core and molding fine 1.75@ 2.00
Arenzville, Ill.—Molding fine..... 1.50@ 1.75
Brass molding..... 1.75
Beach City, Ohio.—Core, washed and screened..... 2.00@ 2.50
Furnace lining..... 2.50@ 3.00
Molding fine and coarse..... 2.25@ 2.50
Cheshire, Mass.—Furnace lining, molding fine and coarse..... 5.00
Sand blast..... 5.00@ 8.00
Stone sawing..... 6.00
Cleveland, Ohio.—Molding coarse..... 1.50@ 2.00
Brass molding..... 1.50@ 2.00
Molding fine..... 1.50@ 2.25
Core..... 1.25@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, f. o. b., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Attica, N. Y.	.75	.75	.75	.75	.75	.75
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		.75	.90		1.25	
Farmingdale, N. J.	.48	.48	.75		1.10	
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias, N. Y.	.75	.75	.85	.85	.85	.85
Pittsburgh, Pa.	1.25	1.25	1.25	.85	.85	.85
Portland, Me.		.50	1.75		1.35	1.35
Washington, D. C. (Rewashed, river)	.60@ .75	.60@ .75	1.60	1.40	1.20	1.20
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.50	.40				.90
Barton, Wis.		.40@ .60		.50@ .70	.50@ .70	
Beloit, Wis.		.70			.80	
Chicago, Ill.		1.75@2.23	1.75@2.43			
Cincinnati, Ohio	.70	.65	.90	.90	.90	.90
Columbus, Ohio	.75	.75@1.00	.75@1.00	.75	.75@1.00	.75@1.00
Des Moines, Iowa	.50	.50	1.25	1.60	1.60	1.60
			Unwashed ballast, .50 ton			
Moronts, Ill.	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80
Oregon, Ill.	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80
Ottawa, Ill.	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80
Yorkville, Ill.	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80
Dresden, Ohio	.70	.60	.60		.90	
Earlestead (Flint), Mich.	.70					
Eau Claire, Wis.	.40@ .50	.40	.85@1.25			.85
Elkhart Lake, Wis.	.66	.66	.70	.70	.70	.70
Grand Rapids, Mich.		.50		.80		.70
Hamilton, Ohio		1.00			1.00	
Hawarden, Iowa	.60	.50			1.60	
Hersey, Mich.	.50				.70	
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Mason City, Iowa	.70	.65	1.75	1.70	1.65	1.60
Mankato, Minn.	.50	.50	1.25@1.35	1.25@1.35	1.25@1.35	1.25@1.35
Milwaukee, Wis.	1.11	1.11	1.36	1.36	1.36	1.36
Minneapolis, Minn.	.35	.35	1.25@1.35	1.25@1.35	1.25	1.25
Moline, Ill.	.60	.60		Concrete gravel, 40% G., 60% S., .90		
Riton, Wis.		.40			.60	
St. Louis, Mo., f.o.b. cars	1.20	1.45	1.65	1.45		2.10
St. Louis, Mo., deliv. on job	2.05	2.20	2.35	2.15		
Summit Grove, Clinton, Ind.	.65@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75
Terre Haute, Ind.	.75	.60	1.00	.90	.75	.75
Waukesha, Wis.	.50	.50	.80	.80	.80	.80
Winona, Minn.	.40	.40	1.25	1.25	1.10	1.10
			(.05 ton discount 10 days)			
Zanesville, Ohio		.60	.60	.90	.90	
SOUTHERN:						
Atlanta, Ga.	1.24	1.24	2.79	1.90	1.90	1.90
Birmingham, Ala.	1.29	1.29	2.79	1.79	1.64	1.54
Charleston, W. Va.	all sand 1.40		all gravel 1.50			
Estill Springs, Tenn.	1.35	1.35		1.00	.85	.65
Ft. Worth, Texas	1.50@2.00	1.50@2.00	1.75@2.00	1.75@2.00	1.75@2.00	1.75@2.00
Jackson's Lake, Ala.	.50@ .60	.50@ .60	.40@1.00	1.00	.50@1.00	.50@1.00
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.20
Lake Weir, Fla.		.50				
Macon, Ga.		.50@ .75				
Memphis, Tenn.	1.00	1.00	1.80	1.80	1.80	1.80
N. Martinsville, W. Va.	1.00				1.20	.80
New Orleans, La.	.25	1.35				
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Los Angeles, Calif.		85@1.15	1.65	1.65	1.50	1.50
Pueblo, Colo.	1.10*	.90*			1.50*	
San Diego, Calif.†	.50@ .70	.80@1.00	1.30@1.60	1.35@1.65	1.10@1.40	1.10@1.40
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.25*	1.25*	1.50*	1.25*	1.25	1.25*
Spring Valley, Calif.	.70	.80	1.40	1.35	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine sand, 1/10 in.	Sand, ¼ in.	Gravel, ½ in.	Gravel, 1 in.	Gravel, 1½ in.	Gravel, 2 in.
Atlanta, Ga.	.30@ .40	.30@ .40				
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, .80 per yd.			
Cherokee, Iowa			.80 per ton—1.20 washed			
Dresden, Ohio					.25	
Dudley, Ky. (crushed sand)	1.00	1.00		.90		
East Hartford, Conn.			.65 per cu. yd.			
Elkhart Lake, Wis.	.70	.50			.60	.60
Estill Springs, Tenn.						.85
Fishers, N. Y.		.60			.55@ .60	
Grand Rapids, Mich.						.60
Hamilton, Ohio					.70	
Hartford, Conn.		1.00*				
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Lindsay, Texas						.55
Mankato, Minn.			All sand and gravel .60 per ton			
Moline, Ill.	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Montezuma, Ind.			Road gravel .50 per ton			
Pine Bluff, Ark.			Road gravel .50			
Rochester, N. Y.	.60@ .75	.60@ .75			.50@ .65	.50@ .65
Roseland, La.	.25					
Saginaw, Mich., f.o.b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo.			About 60% gravel, 40% sand, 1.55			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waco, Texas		.80		1.50		1.30
Winona, Minn.				.60		
York, Pa.		1.00@1.20	(crushed rock sand)			
Zanesville, Ohio		.60	.60			

*Cubic yard. †Low prices, wholesale; high prices, retail.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y.	2.35	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn. and Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Erie, Pa.	Crushed run slag, 4 in. and less, 1.25@1.35						
Emporium, Pa.			1.25	1.25		1.25	1.25
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.	All sizes, 1.50, f.o.b. Chicago						
Detroit, Mich.	All sizes, 1.65, f.o.b. Detroit						
Ironton, O.	2.05	1.45	1.80	1.45	1.45	1.45	1.45
Jackson, O.		1.35		1.35	1.35	1.35	1.35
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
Steubenville, Lowellville, Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Alabama City, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ashland, Ky.		1.55		1.55	1.55	1.55	1.55
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton and Roanoke, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Adams, Mass.			7.00				2.90	
Bellerionte, Pa.		10.50*	10.50*	10.50*	9.00		8.50	1.80
Buffalo, N. Y.				12.00				
Berkeley, R. I.			12.00					2.30
Cassadaga, N. Y.			Agricultural marl 7.00					
Lime Ridge, Pa.							5.00a	
West Rutland, Vt.	13.50	12.00					11.00	3.20
West Stockbridge, Mass.								2.25
Williamsport, Pa.			10.00				6.00	
York, Pa. (dealers' prices)		11.00	11.00	11.00			9.50	1.65
CENTRAL:								
Cold Springs, Ohio	12.50	11.00	10.00		9.00	11.00	10.00	
Delaware, Ohio	12.50	11.00	10.00	11.50	10.00		10.00	1.60
Gibsonburg, Ohio	12.50	11.00	10.00		9.00	11.00	10.00	
Huntington, Ind.		11.00	10.00		9.00		10.00	
Luckey, Ohio	12.50‡	11.00	10.00‡					
Marblehead, Ohio		11.00	10.00				10.00	1.60
Marion, Ohio		11.00	10.00				10.00	1.80†
Mitchell, Ind.				12.00	11.00		10.00	1.60
Sheboygan, Wis.							10.00	
Tiffin, Ohio					9.00	11.00		
White Rock, Ohio	12.50				9.00	11.00		
Woodville, O. (dlrs.' price)	12.50‡	11.00‡	10.00‡				10.00	1.60
SOUTHERN:								
Erin, Tenn.							9.00	1.50
El Paso, Texas					12.00		10.00	1.50
Karo, Va.							7.00	1.50
Knoxville, Tenn.	12.50	11.00	11.00	11.00		11.00	8.50	1.50
Ocala and Zuber, Fla.	14.00	14.00		14.00				1.75
Sherwood, Tenn.	12.50	11.00	11.00	11.00			8.50	1.50
Staunton, Va.					4.50		8.50	1.35
WESTERN:								
Colton, Calif.			15.00				19.70	
Kirtland, N. M.							12.50	
San Francisco, Calif.	22.00	22.00	15.00	22.00				2.40
Tehachapi, Calif.							13.00	2.05

*Paper sacks; †180-lb. net, non-returnable metal barrel; ‡50-lb. paper bags, terms 30 days net, 25c per ton or 5c per bbl. discount for cash in 10 days from date of invoice; ‖80-lb. paper bags; (a) F. O. B. kilns.

Miscellaneous Sands

(Continued from preceding page)

Columbus, Ohio.—Core	.50@	2.00
Sand blast	4.50@	5.50
Molding fine	2.75@	3.00
Brass molding		2.50
Furnace lining	1.50@	2.00
Sand blast	3.50@	5.00
Molding coarse	1.50@	2.50
Stone sawing	1.50@	3.50
Traction	.50@	.90
Delaware, N. J.—Molding fine		2.00
Molding coarse		1.90
Brass molding		2.15
Dunbar, Pa.—Traction		2.50
Dundee, Ohio.—Glass, core, sand blast traction		2.50
Molding fine, brass molding (plus 75c for winter loading)		2.00
Molding coarse (plus 75c for winter loading)		1.75
Eau Claire, Wis.—Sand blast	3.00@	3.25
Traction	.35@	.40
Falls Creek, Pa.—Molding, fine and coarse		1.75
Sand blast		2.00
Traction		1.75
Franklin, Pa.—Core		2.00
Furnace lining		2.50
Molding fine and coarse		2.00
Brass molding		2.00
Greenville, Ill.—Molding coarse	1.50@	1.60
Joliet, Ill.—No. 2 molding sand and loam for luting purposes; milled		.80
Bank run		.65
Kansas City, Mo.—Missouri river core		.80
Kasota, Minn.—Molding fine	1.60@	1.85
Molding coarse, stone sawing	1.45@	1.75
Klondike, Pacific, Gray Summit, Mo.—Molding fine and coarse, stone sawing, roofing sand		2.00
Mapleton Depot, Pa.—Brass molding		2.00
Molding fine		2.00
Roofing sand		2.50
Mapleton, Pa.—Glass, core, furnace lining, molding fine and coarse; damp, 2.00; dry		2.75
Massillon, Ohio—Molding fine and coarse, furnace lining		3.00
Traction, core		2.75
Michigan City, Ind.—Core, traction		.50
Mineral Ridge, Ohio.—Core, furnace lining, molding fine and coarse, roofing sand, sand blast, stone sawing, traction, brass molding (green)		2.25
Montoursville, Pa.—Core	1.35@	1.50
Traction		1.25
New Lexington, Ohio—Molding fine		2.25
Molding coarse		2.00
Oregon, Ill.—Core	1.50@	2.00
Sand blast		4.00
Stone sawing	2.00@	2.50
Ottawa, Ill.—Core	1.50@	2.50
Furnace lining and traction		1.5
Roofing sand		1.50
Sand blast		
Stone sawing		4.50
Brass molding		2.50
Molding, coarse (crude)	.85@	1.00

Miscellaneous Sands

(Continued)

Ottawa, Minn.—Crude silica sand	.75@	1.00
Ridgway, Pa.—Core		2.00
Furnace lining, molding fine, molding coarse		1.25
Traction		2.25
Rockwood, Mich.—Core	1.90@	2.50
Roofing		2.75
Sand blast		3.75
Round Top, Md.—Core (damp)		1.60
Traction (damp)		1.75
Roofing sand		2.25
San Francisco, Calif. (washed and dried)—Core, molding fine, roofing sand and brass molding	3.00@	3.50
(Direct from pit)		
Furnace lining, molding coarse, sand blast		3.60
Stone sawing, traction		2.30
St. Louis, Mo.—Red heavy molding	1.50@	2.25
Red fine	1.50@	2.00
Molding fine and brass	2.00@	3.00
Skein core	1.75@	2.25
White core sand	1.00@	1.75
Sand blast	2.00@	4.50
Furnace lining	1.50@	2.50
Roofing sand	1.00@	1.50
Stone sawing	1.25@	2.00
Thayers, Pa.—Core		2.00
Furnace lining, molding fine and coarse		1.25
Traction		2.00
Utica, Ill.—Core, molding fine, molding coarse	.70@	1.50
Furnace lining	.85@	1.50
Roofing sand, stone sawing	1.40@	2.50
Traction, brass molding		1.40
Sand blast		2.50
Warwick, Ohio.—Furnace lining, dry 1.75, green		2.00
Molding fine and coarse, dry 2.50; green		1.75
Traction and brass molding		2.50
Core, dry	2.50@	2.75
Core, green		1.75
Zanesville, Ohio—Molding fine, brass molding	1.50@	1.75
Molding coarse		1.50

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Asheville, N. C.—Best white and 200-mesh (per ton)	8.00
Yellow (per ton)	9.00
Red (per ton)	13.00
Baltimore, Md.—Crude talc (mine run)	3.50
Ground talc (20-50 mesh), bags	10.00
Ground talc (150-200 mesh), bags	12.00
Cubes	60.00
Blanks (per lb.)	.08
Chatsworth, Ga.—Crude talc	5.00
Ground talc (150-200 mesh); bags	15.00
Pencils and steel workers' crayons	1.50@ 2.50
Chester, Vt.—Crude talc	3.50@ 5.00
Ground talc (150-200 mesh), bags	7.00@ 9.00
Emeryville, N. Y.—325 mesh	14.75
Hailesboro, N. Y.—Ground talc (150-250 mesh), bags	18.00
Henry, Va.—Crude talc (lump mine run) per 2000-lb. ton	3.00@ 3.50
(150-200 mesh), bags	10.00@12.50
Keeler, Calif., bulk	17.00@25.00
Los Angeles, Calif.—Crude	15.00@22.00
Mertztown, Pa.—Ground talc (20-50 mesh); bulk, 5.00; bags	6.00
(150-200 mesh); bulk, 7.00; bags	8.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@13.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@10.00
Ground talc (150-200 mesh), bulk	10.00@22.00
Vermont—Ground talc (20-50 mesh); bags	7.50@10.00
Ground talc (150-200 mesh); bags	8.50@15.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk	5.00
(Bags 1.00 extra)	
Ground talc (150-200 mesh), bulk	8.00@14.00
(Bags 1.00 extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Rock Phosphate

(Raw Rock)

Per 2240-lb. Ton

Centerville, Tenn.—B.P.L. 65%	6.00@ 8.50
Gordonsburg, Tenn.—B.P.L. 68-72%	5.50@ 6.00
Mt. Pleasant, Tenn.—Analysis, .65-70% B.P.L. (2000 lb.)	6.50
Tennessee—F. O. B. mines, gross ton, unground Tenn. brown rock, 72% min. B.P.L.	7.00
Paris, Idaho.—2000 lb. mine run, B.P.L. 75%	4.50@ 5.00
Ottawa, Minn.—All crude silica sand	.75@ 1.00

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Clay Roofing Slate, f. o. b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$10.20	$8.40	$8.10	$7.50
24x14	10.20	8.40	8.10	7.50
22x12	10.80	8.70	8.40	7.80
22x11	10.80	8.70	8.40	7.80
20x12	12.60	9.00	8.70	8.10
20x10	12.60	9.00	8.70	8.10
18x10	12.60	9.00	8.70	8.10
18x 9	12.60	9.00	8.70	8.10
16x10	12.60	8.70	8.40	7.80
16x 9	12.60	8.70	8.40	7.80
16x 8	12.60	8.70	8.40	7.80
18x12	12.60	9.00	8.70	8.10
16x12	12.60	8.70	8.40	7.80
14x10	11.10	8.40	8.10	7.50
14x 8	11.10	8.40	8.10	7.50
14x 7 to 12x6	9.30	8.10	7.50	7.50
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$8.10	$7.20	$5.75
22x11	8.40	8.40	7.50	5.75
Other sizes	8.70	8.70	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

(Continued from preceding page)

(Ground Rock)

Wales, Tenn.—B.P.L. 70%	7.75
Per 2000-lb. ton	
Barton, Fla.—Analysis, 50-65% B.P.L.	3.50@ 8.00
Centerville, Tenn.—B.P.L., 65%	6.50*
Benotis, Fla.—Analysis 77-82% B.P.L.	8.00
Montpelier, Idaho. — Analysis, 72% B.P.L., crushed and dried	3.75
Mt. Pleasant, Tenn.—B.P.L., 65%	6.50
Twomey, Tenn.—B.P.L. 65%	6.50

*Less $1.00 per ton dealer commission.

Florida Soft Phosphate

(Raw Land Pebble)

	Per Ton
Benotis, Fla.—Analysis 26-28% phosphoric acid—200 lb. sacks, carload lots	10.00
Florida—F. O. B. mines, gross ton, 68/66% B.P.L.	3.25
70% min. B.P.L.	3.55
72% min. B.P.L.	3.85
Jacksonville (Fla.) District	10.00@12.00

(Ground Land Pebble)

	Per Ton
Jacksonville, Fla., District	14.00
Add 2.50 for sacks.	
Morristown, Fla.—26% phos. acid	16.00
Mt. Pleasant, Tenn.—65% B.P.L.	5.75

Fluorspar

Fluorspar—80% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	22.00
Fluorspar—85% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	23.50

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b. quarries		17.50
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Evergreen, creme green and royal green marble	16.00@20.00	16.00@20.00
Slate granules		6.50@ 7.00
Granville, N. Y.—Red slate granules		7.50
Harrisonburg, Va.—Blk. marble (crushed, in bags)		12.50
Ingomar, Ohio (in bags)		8.00@25.00
Milwaukee, Wis.		14.00@26.00
New York, N. Y.—Red and yellow Verona		32.00
Middlebrook, Mo.—Red		25.00@30.00
Phillipsburg, N. J.	16.00@20.00	14.50@18.00
Poultney, Vt.—Slate granules		7.50
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Tuckahoe, N. Y.—(2000 lb.)		8.00@12.00
Whitestone, Ga.—White marble chips, net ton in bulk, f.o.b., bags 12½c extra	4.50	4.50

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	27.00@35.00
Carpenterville, N. J.	19.00	31.50
Easton, Pa.	16.00	40.00@60.00
Eau Claire, Wis.	15.00@20.00	25.00@40.00
Ensley, Ala.	16.00	26.00
Eugene, Ore.	25.00@26.00	50.00@75.00
Friesland, Wis.	22.00	32.00
Houston, Tex.		19.50
Omaha, Neb.	18.00	30.00@40.00
Portland, Ore. (Del'd)	21.00	30.00@60.00
Puyallup, Wash.	20.00	60.00@75.00
Rapid City, S. D.	18.00	25.00@40.00
St. Paul, Minn.	15.00	30.00@37.50
Salem, Ore.	25.00	35.00@50.00
Salt Lake City, Utah	17.00@18.00	35.00@40.00
Springfield, Ill.	18.00	20.00@25.00
Wauwatosa, Wis.	15.00@16.00	28.00@75.00
Watertown, N. Y.	21.00@22.50	35.00@37.50
Winnipeg, Can.	18.00	26.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	11.00
Boston, Mass.	15.00@16.50
Buffalo, N. Y.	16.50
Dayton, Ohio	12.50@13.50
Grand Rapids, Mich.	12.00
Lancaster, N. Y.	15.00
Michigan City, Ind.	11.00
Milwaukee, Wis. (delivered)	14.00
Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Portage, Wis.	15.00
Rives Junction, Mich.	12.00
Saginaw, Mich.	12.00
San Antonio, Texas	13.00
San Antonio, Texas (deliv. city lts.)	13.00
South Dayton, Ohio	12.50@13.50
Syracuse, N. Y. (delivered at job)	20.00
F.o.b. cars	15.00

Gray Klinker Brick

El Paso, Texas	13.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Common
Atlanta, Ga.	22.50	14.00
Baltimore, Md.	24.25	17.25
Cincinnati, Ohio	16.80	14.30
Chicago, Ill.	20.00	20.00
Dallas, Tex.	22.00	22.00
Denver, Colo.	24.00	.....
Detroit, Mich.	21.00	20.00
Minneapolis, Minn. (white)	25.50	21.00
Montreal, Que.	.....	21.00
New York, N. Y.	18.20	13.10
St. Louis, Mo.	23.20	20.00
San Francisco, Calif.	22.00	.....
Seattle, Wash. (paper sacks)	24.00	.....

Portland Cement

Prices per bbl. and per bag net in carload lots.

	Per Bag	Per Bbl.
Atlanta, Ga.	.....	3.00
Boston, Mass.	.....	2.68@2.78
Buffalo, N. Y.	.....	2.53
Cedar Rapids, Iowa	.62	2.48
Cincinnati, Ohio	.63½	2.54
Cleveland, Ohio	.61½	2.46
Chicago, Ill.	.55	2.30
Columbus, Ohio	.....	2.49
Dallas, Texas	.56¼	2.25†
Davenport, Iowa	.60¼	2.43
Dayton, Ohio	.....	2.48
Denver, Colo.	.....	2.65
Detroit, Mich.	.62	2.48
Duluth, Minn.	.56¼	2.14
Indianapolis, Ind.	.60¼	2.41
Kansas City, Mo.	.61¼	2.45
Los Angeles, Cal. (less 5c dis.)	.....	2.86
Memphis, Tenn.	.....	2.84
Milwaukee, Wis.	.59¼	2.46
Minneapolis, Minn.	.62½	2.61
Montreal, Canada (sks. 20c ext.)	.....	2.40
New Orleans, La.	.....	2.83
New York, N. Y.	.....	2.40
Philadelphia, Pa.	.....	2.56
Phoenix, Ariz.	.....	3.30
Pittsburgh, Pa.	.56	2.24
Portland, Ore.	.....	3.05
San Francisco, Cal.	.....	2.63*
St. Louis, Mo.	.58¾	2.35
St. Paul, Minn.	.62½	2.61
Seattle, Wash. (10c bbl. dis.)	.....	2.90
Spokane, Wash.	.....	.....
Toledo, Ohio	.62	2.48

†Sack 10c ext.; 10c dis. 10 days.
*Warehouse, 3.15.

NOTE—Add 40c per bbl. for bags.

Mill prices f. o. b. in Carload Lots to Contractors

	Per Bag	Per Bbl.
Buffington, Ind.	.48¾	1.95
Cincinnati, Ohio	.....	3.00†
Concrete, Wash.	.....	2.60
Dallas, Texas	.....	2.15
Dayton, Ohio	.....	2.85†
El Paso, Tex.	.....	3.20*
Hannibal, Mo.	.....	2.10
Hudson, N. Y.	.....	2.20
Indianapolis, Ind.	.....	2.96†
Leeds, Ala.	.....	2.20
Los Angeles, Calif.	.....	2.80
Louisville, Ky.	.....	2.92†
Memphis, Tenn.	.....	3.24†
Northampton, Pa.	.....	2.10
Phoenix, Ariz.	.....	4.30‡
Steelton, Minn.	.51½	2.06
Universal, Pa.	.50	2.00

†Including cloth sacks.
*Gross, 10c sacks and 10c per bbl. disc 10 days.
‡Gross, 15c sacks and 5c per bbl. disc. 10 days.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco* Calcined Gypsum	Cement‡ and Gauging Plaster	Wood Fiber	White§ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ⅜x32x36" Weight 1500 lb. Per M Sq. Ft.	⅜x32x36" Weight 1850 lb. Per M Sq. Ft.	Wallboard. ⅜x32 or 48" Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Douglas, Ariz.	.....	6.00	6.00	.....	13.00	.....	.....	.....	.....	.....	.....	.....	.....
Fort Dodge, Iowa	3.00	3.50	6.00	8.00	10.00	10.50	20.00	.....	21.30	20.00	20.00	.....	30.00
Garbutt, N. Y.	.....	.....	6.00	8.00	10.00	10.00	.....	7.00	.....	.....	.....	20.00	.....
Grand Rapids, Mich.	3 00	.....	5.00	10.00	10.00	10.00	.....	.....	31.00	.....	19.75	20.00	30.00
Hanover, Mont.	4 50	.....	6.00	10.00	.....	10.50	.....	.....	.....	.....	.....	.....	.....
Mound House, Nev.	.....	8.50	6.50	10.50@11.50	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oakfield, N. Y.	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	30.75	21.00	19.375	20.00	30.00
Rapid City, S. D.	4.00	.....	.....	10.00	11.00	11.50	.....	.....	33.75	.....	.....	.....	.....
San Francisco, Calif.	.....	.....	.....	16.40	.....	.....	.....	.....	.....	.....	.....	.....	.....
Winnipeg, Man.	5.50	5.50	7.00	13.50	15.00	15.00	.....	.....	.....	.....	28.50	.....	35.00

NOTE—Returnable Bags, 10c each; Paper Bags, $1.50 per ton extra (not returnable).
*Shipment in bulk 25c per ton less; ‡Bond plaster $1.50 per ton additional; +Sanded Wood Fiber $2.50 per ton additional; §White Moulding 50c per ton

News of All the Industry

Incorporations

The Mammoth Plaster & Cement Co., of Cedar City, Utah, filed incorporation articles with the secretary of state yesterday. It is capitalized for $500,000, the shares having a par value of 50 cents each, and was organized for the purpose of manufacturing cement and plaster from gypsum taken from a thousand-acre tract a mile and a half east of Cedar City. The incorporators are M. J. Macfarlane, of Cedar City; Lehi W. Jones, of Cedar City; N. C. Poulson, of Salt Lake; J. G. Pace, of Cedar City; E. M. Corry, of Cedar City; and J. W. Johnson, of Provo.

The Asbestic Stucco Sales Co. has been incorporated in Los Angeles, Cal., with a capital stock of $10,000, by H. R. Kelly, B. M. Warner and C. E. Spencer.

The Rock Products Mfg. Co. has been incorporated in Detroit, Mich., with a capital of $12,000, and is located at 2390 Livernois avenue.

The Farris Bros. & Hart Stone Co. has been incorporated in Los Angeles, Cal., and succeeds to the cast stone business of Farris Bros., at 3201 Humboldt street. J. Roger Farris is president; Fred M. Farris, vice-president and yard manager; and J. P. Hart, secretary and treasurer.

The Silicate Products Co. has been incorporated in Los Angeles, Cal., with a capital of $15,000, by David I. Nelke, New York; D. N. Schwab and F. J. Butler, of Los Angeles.

The Concrete Sales Co. has been incorporated in Asheville, N. C., with a capital stock of $100,000, by J. E. Thayer, C. C. Hauk and others.

The Romans Sand & Gravel Co. has been incorporated in Baltimore, Md., with a capital stock of $40,000, by Alex. Romans, C. Lewis Engel and others. The company is located at 514 E. 39th street.

Delia Farmers' Gin Co., Delia, Limestone Co., Tex.; capital stock $5,000. Incorporators: J. H. Cochrum, W. B. Herring, E. W. Trotter.

Spiro Gravel Co., Spiro, Okla., E. D. Davis, W. W. Brown, Jr., and M. I. Border, all of Oklahoma City; capital $50,000.

The Agricultural Lime and Compost Co., Nevada. Certified copy of articles filed.

Santa Monica Rock and Gravel Co., Los Angeles. Capital stock $60,000; shares 600; subscribed, $300.

R. H. Duphiney & Co., Maywood, Ill., has been incorporated for $25,000 by M. A. Duphiney, R. H. Duphiney and M. C. Simmons, to manufacture and deal in building materials.

The Rock Island Silica Sand Co., 305 Maloney building, Ottawa, Ill., has been incorporated for $10,000 by W. A. Herrick, F. J. Rief and A. A. Rief, to manufacture and deal in building materials. Correspondent is Knapp & Campbell, 208 S. La Salle St., Chicago.

The Clinton Sand and Gravel Co. has been incorporated to mine and deal in sand and building material at 200 North Madison street, Clinton, Ill. The capital stock is $10,000, which has been subscribed and paid in as follows: H. A. Campbell, $2000; A. E. Stone, $2000; Roy H. Johnson, $2000; Onnis Harrold, $2000, and W. F. Gray, $2000, all of Clinton.

The Hampton Coal and Phosphate Co., Livingston, Ky., has been incorporated by George Hanburg, B. L. Crawford and E. M. Nelson.

The Hawkeye Feed Co., Clinton, Iowa, has been incorporated to deal in lime and cement for $50,000 by C. M. Stormes and R. T. Thomas.

Pomona Tile Manufacturing Co., Pomona, Calif. Capital stock, $100,000; shares, 10,000; subscribed, $50.

West Middlesex Pa., Sand Co.—Capital stock $20,000; treasurer, W. W. Johnson, West Middlesex, Pa.

The American Cement Plaster Co., Lawrence, Kans., has decreased its capital from $2500 to $1000.

The Sand-Lime Products Co., Detroit, Mich., has increased its capital stock from $50,000 to $150,000.

Cement

The Yosemite Portland Cement Co. has begun grading on its site near Merced, Cal. The Hunt Engineering Co. will have charge of the construction. It is planned to have the plant ready by March 1. W. E. Cole, Simonson Bldg., Merced, is manager.

The Kansas Portland Cement Co. has announced that it will change from the dry to the wet process, at its Bonner Springs, Kan., plant. Installation of the new machinery required has been begun. The old process will not be abandoned for several months.

The Trinity Portland Cement Co. has purchased the greater part of the machinery required for its Fort Worth, Tex., plant. C. E. Ulrickson is president. It has contracted for 1¼ miles standard gage railroad at a price of $40,000.

Spontaneous combustion is blamed for a fire that occurred in the Lehigh Portland Cement Co. plant at New Castle, Pa., causing damage of about $500. The coal dust in the coal mill of the works is believed to have ignited.

The Indiana Portland Cement Co. will move its offices to the State Life Bldg., Indianapolis.

The State Cement Plant at Rapid City, S. D., has completed one building and put in foundations for larger structures, according to the Sioux Falls Press.

The San Antonio Portland Cement Co. has awarded the contract for steel construction on addition to its plant in San Antonio, Tex.

The Globe Portland Cement Co. announces that it will defer building its plant in Dubuque, Ia., until 1924.

The McDonald Engineering Co. has contract for erection of plant in Bonner Springs, Kas., for the International Cement Co., and work is reported to have begun.

The Superior Portland Cement Co., of Portland, Ore., has let the contract for erection of a combination warehouse, carpenter shop, blacksmith shop and machine shop, to cost $50,000 and be two stories high and 40x375 ft.

The Portland Cement Co. will go ahead with the construction of a $1,000,000 cement factory west of Loveland, Col., if the Colorado & Southern railroad will co-operate by guaranteeing prompt deliveries of hard coal from the east at reasonable rates, according to Charles Boettcher, president of the cement company.

Sand and Gravel

The Grays Harbor Construction Co., of Aberdeen, Wash., has leased the ferry slip near the south approach of the west bridge in Aberdeen.

Nickum & Kelly's sand and gravel warehouse, at the foot of Alder street, Portland, Ore., has been destroyed by fire.

Henry Chase and Sons have sold their interest in the Newberg Sand & Gravel Co., in Newberg, Ore.

The Tennessee River Boat Yards has established a large plant on the Tennessee river, fronting on Riverside drive, Knoxville, Tenn., and the company is actively engaged in getting sand and gravel from the channels of the rivers. The boat yards are owned by Harris & Son and are located below the L. & N. bridge. A number of barges have been constructed recently and a new steamer has been built. Both the steamer and barges will be used in taking sand and gravel from the river.

The Riverside Sand & Gravel Co. has started in the sand and gravel business in Kelso and Longview, Wash. The pit is situated on the Cowlitz river, two miles north of Kelso, the only local material in that locality, and the material has passed the necessary construction tests. The output will be developed to the maximum demand. T. L. Thurston, of Seattle, is president, and H. P. Parvis will be in charge at the plant.

E. L. Dorsey, North Broadway, New Lexington, O., has been awarded a contract by the county commissioners to furnish and deliver 300 four-ton loads of gravel to be applied to I. C. H. 415 in Salem township, on his bid of $1200.

The Norton Sand Co., New York, has leased 100 ft. of bulkhead and 50 ft. of upland from the city of New York for a sand yard. James A. Norton, until recently superintendent of the Materials Delivery Corp., organized the company.

A new highway building material, known as gravel macadam, has been discovered in Pottawatomie county, near Asher, Okla. In appearance it resembles a concrete mixture made from all sizes of pebbles, stones and sand and has a cement mixture that solidifies after it has been put in place, wet down and rolled with a twenty-ton roller. Samples of the material have been submitted to the state highway department, and immediate steps will be taken by capitalists to organize a gravel company, says an Oklahoma daily.

Highway Director L. A. Boulay has declared that his department has made arrangements with 10 counties in Ohio to co-operate in construction and maintenance of more than 100 miles of gravel and loose stone road and that the plan includes gradual widening of the roadbed and bridges, so as to bring the highways in question up to standard. According to the Bellefontaine, O., Examiner, Mr. Boulay estimates the cost of such highways will be $1600 a mile.

The Trent Concrete Co. has substituted American tractors for barge horses in towing at Colwick, near Nottingham, England. A tractor weighing one ton was used for hauling an 80-ton gravel barge for a distance of about three miles, according to Consul H. C. Blair, and the trip was completed in 55 minutes. This method, unique in the United Kingdom, has been adopted by the company because the tractor can make five round trips a day compared with two and a half trips made by a towing outfit of three horses.

Rock Asphalt

A Steinberger, St. Louis, is developing 173 acres of rock asphalt deposit, near Ada, Okla.

The National Asphalt Refining Co., Richards, Mo., has begun the sinking of a shaft to a 42-ft. vein of asphalt, and will install a power plant and other machinery.

The Natural Rock Asphalt Co., of Brownsville, Ky., will develop its asphalt property in Edmonson county, Ky. The company has $350,000 paid in capital. C. K. Kirkpatrick is president.

Quarries

The Lincoln Crushed Stone Co., Salina, Kas., is making some big improvements at its plant just south of town, which will mean much to the capacity of the plant. Recently they made a contract with the Rees Bros. for electricity to be generated at the mill, and a power line is being built from the mill to the crusher. At the quarry a new air compressor is being installed and three large electric motors put in—one a 50 horse power, the other two 40 each. This arrangement will permit the plant to operate entirely by electric power, making it possible to use seven of the jack hammers now in the quarry.

J. M. Whiting, Harrisburg, Pa., has been awarded the contract for crushed stone for the Fishing Creek road, the price being $2.40 per ton.

Reduced rates on crushed stone from Spencer and Greencastle, Ind., to 211 destinations on eight railroads were ordered by the public service commission today. The new rates are to go into effect on or before September 20, the order says. The commission refused to order a reduction in the rates to Indianapolis, holding those rates reasonable. The order was issued on petition of the Midwest Crushed Stone Quarries Co.,

(Continued on page 60)

STURTEVANT

Moto-Vibro Screen

Vibration that Vibrates
Every Wire and Every part of Every Wire
Nothing can remain still on this Screen
It must either pass through or over
10 mesh cloth presents 25,920 openings
100 mesh cloth presents 259,200 openings
in each Screen Unit
All of these meshes are gaping holes
Kept clean by vibrations
All four sides of each opening are vibrated 1800 times per minute.

All particles too large to pass are immediately rejected and those smaller than the meshes cannot help falling through.

The vibration is equally efficient all over the screen; whether at top, bottom, middle or sides, there are no high, low or dead spots.

It is simple, durable, accessible, has no auxiliaries, no motor generator and is less expensive than most screens.

STURTEVANT MILL CO. HARRISON SQUARE **Boston, Mass.**

When writing advertisers please mention ROCK PRODUCTS

of Indianapolis, which has quarries at Spencer and Greencastle. Lawrence R. Cartwright, vice-president of the republican state committee, is vice-president of the company.

Claremont, Okla.—Rogers county commissioners have plans calling for the building of 112 miles of limestone highways at a cost of $650,000 and bonds for this amount are expected to be voted next month.

Edward Shoemaker has retired from the limestone quarrying firm of Ross & Shoemaker, in Gold Hill, Ore.

The Luecders Building Stone Co. is soon to install additional equipment at its quarry, Luecders, Tex.

James F. Faulkner, Ball Ground, Ga., is in the market for marble quarry machinery.

The Gibbons & Lawrence Construction Co. is planning the establishment of a rock crushing plant in Golden, Colo., to cost about $50,000.

The Cleveland Stone Co., 1836 Euclid avenue, Cleveland, O., of which Chas. W. Walters is president, is about to erect a $75,000 manufacturing plant in Amherst, O.

Pratt Building Material Co., Folsom, Calif., expects to construct a rock crushing plant within 60 days.

H. C. King, engineer of Okamulgee county, Okla., says that the county will save $25,000 by the installation of a new rock crushing plant. The equipment includes a steam hammer, steam drills and a light railroad track, according to the Tulsa, Okla., World.

Agstone

Orders for 18 cars of limestone were placed through the Henry county, Illinois, farm bureau last week. The average amount in a car is a little more than 40 tons. The best price obtainable now is $1.19 a ton, delivered to points on the Rock Island, and $1.46 to points on the C., B. & Q., according to the Moline, Ill., Dispatch. Several of the farmers who ordered limestone are starting out systematically to cover their entire farms. Except for an area of flat land around Atkinson and Annawan, practically all the land of the county is acid and requires lime in order to grow alfalfa or sweet clover satisfactorily.

Farmers south and east of Blandinsville, are hauling quite a bit of ground limestone on to their fields. Sterling Roberts has hauled 50 tons and J. E. Stickle, Porter Knapp and others are getting different amounts. It comes from Kankakee and costs $1.80 per ton delivered here. Of this the manufacturers get 49 cents per ton and the railroad the rest. It costs $1.31 to ship 49 cents worth of material.—Blandinsville, Ill., Star-Gazette.

Robert Karrmann and Elmer Richards, of Platteville, Wis., have installed a small crushing plant for crushing agstone and road material.

More than 200 farmers of Hamilton county, Ohio, assembled yesterday at Glenview farm, near Glendale, to receive the first train load of agricultural lime ever shipped to Ohio for farming purposes. The train load was of 35 cars, shipped from a marble plant at Piqua and consigned to W. E. Stone, county agent of the Farm Bureau of Hamilton county, as representing the 130 farmers who were its buyers. The lime was valued at about $5000.

Bulletin No. 61 of the Department of Soils, Ohio State University, says that some soils in Ohio are so acid as to require 20 tons of limestone per acre to correct the acidity.

The New Hamp. Expt. Station says that soil samples from 2500 representative acres in the state testify to the need of two to three tons per acre of ground limestone.

Concrete Products

The Ashton Equipment Co. of Chicago has obtained an option on the old canning factory and soon will erect a $50,000 cement block building 60x100 feet in size. Fifty men will be employed within a month, it is said.

The California Staff & Stucco Co. is the name of a new firm, located at 1302 Willow street, Los Angeles, Cal., the members of which are John Rucker, Glendora, Cal.; Fred Giovannzzi, 1443 Henry St.; and John Giovannzzi, of 814 Roosevelt St., Los Angeles.

The Sunset Staff & Stone Works, 7416 Santa Monica blvd., Los Angeles, Cal., has engaged in business. R. Rodriguez is a member of the firm.

The Burns Construction Co., Sarasota, Fla., of which Owen Burns is president, will establish a plant for the manufacture of concrete blocks and building tile.

The Valley Concrete Pipe Co. of this city has purchased from James F. King of Gridley, Calif., his concrete pipe manufacturing plant located at Gridley. The new owners have already taken over the business, King remaining in charge until G. Wiliamson arrives in Gridley to manage the plant.

The Cinder Brick & Tile Co. is having plans drawn for the erection of a factory to cost about $25,000 on Duffield avenue, in Jersey City, N. J.

Sand-Lime Brick

The Detroit Sand-Lime Brick Co., of which W. F. Newman is president, is about ready to let the contract for a brick plant at River Rouge, Mich.

Slate

The El Dorado Slate Products Co., Sacramento, Cal., is opening up an extensive slate deposit in Placerville, El Dorado county. Leroy W. Taber is secretary of the company.

Gypsum

The Gypsum Products Co. will start work at once on erection of a plant in Alamogordo, N. M.

Trade Literature

The Celite Products Co. have adopted the trade mark shown. As all the products of this company are installed or utilized as a wall or barrier, the symbol is appropriate. Celite products are used as heat insulators for waterproofing exterior walls, and for preventing air filtration through furnace walls. Other products are those used for facilitating filtration and a high temperature cement.

The Sullivan Machine Co. has issued the following new bulletins: 77-G on the Sullivan single state, steam-driven air compressor; 79-H, describing an overcutting coal mining machine; 72-H, a new edition of the bulletin on the Sullivan drill steel sharpeners, and 81-B, on the Sullivan redesigned Rotator drills.

The Rubert M. Gay Co. has issued bulletin D, describing its air separator for use in the fine grinding of all kinds of minerals. Although it is called an air separator, centrifugal force is really the separating agent, the air being used merely to convey the material through the machine.

The Bucyrus Co. describes its new 20-B gasoline universal shovel in bulletin F-20, which it has just issued.

The Westinghouse Electric & Manufacturing Co. has issued a new catalogue covering line material and porcelain insulators. The catalog is supplementary to the company's large supply catalogue has been issued for the convenience of purchasers of these two allied lines of materials. It is a 200 page publication of convenient size, is fully illustrated, and contains a complete description of all the company's line material and porcelain insulators.

The Dayton-Dowd Co. has issued a very good bulletin describing the centrifugal water pumps which it makes. A data sheet (No. 12), issued with this bulletin, will be of interest to pump users, as it gives the result of the company's engineers investigation of the effect of slippage through the wearing rings of a centrifugal pump.

Sauerman Bros. have issued an excellent pamphlet (No. 20) on their power drag scraper. This machine is growing in favor for medium and small gravel operations and for handling material in and out of stock piles.

The Fate-Root-Heath Co. is sending out Bulletin D, illustrating the many uses of the Plymouth gasoline locomotive in general construction.

The Kennedy-Van Saun Mfg. and Eng. Corp. have issued a handsome general catalog describing "Kennedy Products." These include crushers, rolls, screens, classifiers, log washers, tube mills, dryers, etc.

The Products Mfg. & Sales Co. has issued a folder describing Babbitrite. This is a new composition that takes the place of clay and putty in babbitting. It is free from the objections of these materials in that it is not affected by heat and will not dry out or harden. It can be used repeatedly.

Manufacturers

The Burke Electric Co. announces that James R. Downs, manager of the Pittsburgh office, has been promoted to the position of manager of the mining department and his assistant, Mr. Wallace, has been promoted to Mr. Downs's place.

James B. Severens, engineer and contractor, has recently established a shop for making bucket loaders, shaking screens, clamshell buckets, locomotive cranes and other equipment used by contractors. The shop is also well equipped for repair work. Not only Mr. Severens' own work, but that of other contractors will be handled.

Graphite

The Dixie Consolidated Graphite Co., Birmingham, Ala., has perfected plans for the construction of a new plant on site selected at Chattanooga, Tenn., to include a power house and machine shop, in conjunction with main manufacturing plant, estimated to cost $250,000, including machinery. C. E. Watson is president.

Cost of Moving Earth by Hydraulicking

THE data given below is from an article "Sluicing a Mountain Into the Sea" published in the *Pure Iron Era*. The story describes the hydraulicking operation by which a mountain near the city of Rio de Janeiro, Brazil, is being leveled and the dirt carried to the harbor to make new building sites.

Years ago the work of removing this hill was started by native contractors who used mule drawn carts to carry the dirt and stone to the sea wall. In estimating the cost of this work it was found that it would be something like 75 cents a cu. yd. and would take eight years to remove. With the three high-powered pumps now installed it will not cost more than 25 cents a cu. yd. for the entire project.

The material to be removed is 15 per cent rock and 85 per cent dirt. Each pump will take care of four hydraulic giants, with a 3½-in. stream at the nozzle. Twelve of these giants will shoot the earth from the top of the hill to the fill-in. A sea wall, three miles long and half a mile wide has been constructed to receive the debris.

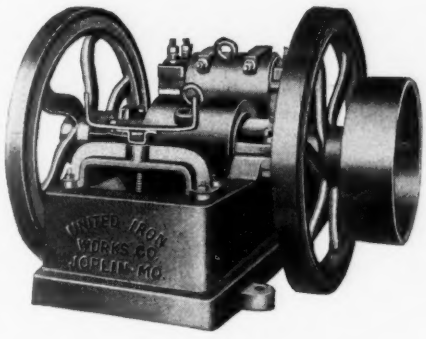
Close to the new land being made along the water front will stand the permanent United States embassy building now under construction.

Since the early part of 1921, dynamite, steam shovels, dirt trucks, construction trains, dredge pipe, hydraulic equipment and human energy have been constantly at work. At the beginning, steam shovels and dirt trucks were largely employed but this slower method was replaced by more economical engineering practices.

Hydraulic pressure has replaced the steam shovels and special-analysis "Armco" steel dredge pipe has replaced the dirt trucks. Thousands of tons of soil and water have been sluiced through four thousand feet of this pipe. This method of earth removal has proved exceedingly economical, as the pipe is of such a quality that it withstands the abrasive action of the moving sand, gravel and shattered rock.

At Rio nearly 7,000,000 cu. yd. of earth and rock have already poured into the bay.

The "UNITED" CRUSHER



"UNITED" IRON WORKS INC. FOR SERVICE

The wearing parts of "United" Jaw Crushers are all made from a special semi-steel mixture, perfected after years of testing and an expenditure of thousands of dollars.

The wearing qualities approach that of steel at a fractional cost. Our guaranteed service of prompt shipment of any part required insures a minimum of delay in case of breakdowns or accidents.

Plain Jaws are regularly furnished. Corrugated Jaws are better adapted to some stone and can be furnished on special order.

These crushers are furnished in eight sizes. Openings from 7″x10″ to 12″x24″ with capacities for 6 to 35 tons per hour.

Send for Special Bulletins

UNITED IRON WORKS, INC.
GENERAL OFFICES: KANSAS CITY, MO.

Where There Is Undivided Responsibility

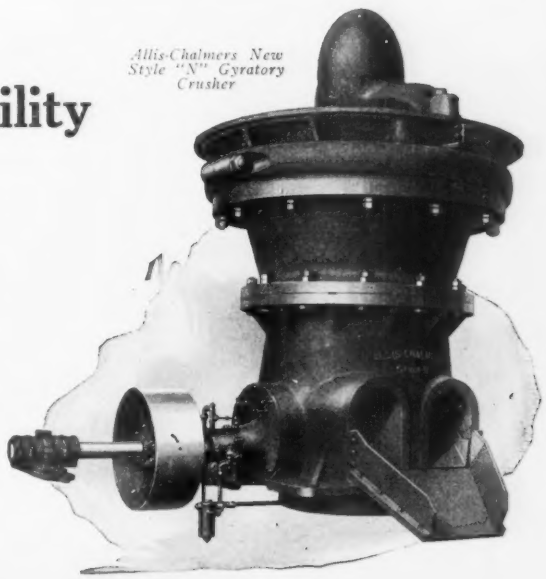
Whether you are planning a new plant, an extension or a replacement, the value of undivided responsibility in connection with your new equipment is an important consideration.

Allis-Chalmers equipment used in many of the leading plants of the country includes heavy machinery for many varied engineering and power purposes, prime movers of all types among which are some of the largest units ever built, complete crushing and cement plants for large dams and irrigation projects, electrical apparatus and many complete lines of industrial machinery.

By reason of this experience the Allis-Chalmers Organization is able to propose and furnish equipment best suited to meet the particular requirements of its customers. With complete equipment built by one organization, under a single supervision, the many details, complications and delays incident to divided responsibility are avoided.

Let us figure on your requirements

Allis-Chalmers New Style "N" Gyratory Crusher



ALLIS-CHALMERS PRODUCTS
Electrical Machinery
Steam Turbines
Steam Engines
Gas and Oil Engines
Hydraulic Turbines
Crushing and Cement Machinery
Mining Machinery

ALLIS-CHALMERS MANUFACTURING COMPANY

MILWAUKEE, WISCONSIN, U.S.A.

ALLIS-CHALMERS PRODUCTS
Flour and Saw Mill Machinery
Power Transmission Machinery
Pumping Engines-Centrifugal Pumps
Steam and Electric Hoists
Air Compressors - Air Brakes
Agricultural Machinery
Condensers

Buyers' Directory
of the Rock Products Industry

Classified Directory of Advertisers in this issue of Rock Products

Air Compressors
Pennsylvania Pump & Compressor Co., Easton, Pa.
Smokeless Oil Burner Co., Bucyrus, Ohio
Worthington Pump & Mchy. Corp., New York

Air Separators
Rubert M. Gay Co., New York, N. Y.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Universal Road Mchy. Co., Kingston, N. Y.

Augers
Howells Mining Drill Co., Plymouth, Pa.

Automatic Weighers
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

Babbitt Metal
Ajax Metal Co., Philadelphia, Pa.

Bags and Bagging Machinery
Jaite Co., Jaite, Ohio
Valve Bag Co. of America, Toledo, Ohio

Balls (Tube Mill, etc.)
Hadfield-Penfield Steel Co., Bucyrus, Ohio
Worthington Pump & Mchy. Corp., New York

Belting
New York Belting & Packing Co., New York City

Belt Fasteners and Hooks
Crescent Belt Fastener Co., New York City

Belt Lacing and Rivets
Crescent Belt Fastener Co., New York City

Bins and Bin Gates
Austin-Western Road Machinery Co., Chicago, Ill.
Smith Engineering Works, Milwaukee, Wis.
W. Toepfer & Sons Co., Milwaukee, Wis.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

Boiler Insulation
Celite Products Co., Chicago, Ill.

Boilers (Return and Water Tube)
Jackson & Church Co., Saginaw, Mich.

Box Car Loaders
Ottumwa Box Car Loader Co., Ottumwa, Iowa

Brick (Insulating)
Celite Products Co., Chicago, Ill.

Brick Machinery
Hadfield-Penfield Steel Co., Bucyrus, Ohio
Jackson & Church Co., Saginaw, Mich.
Shope Brick Co., Portland, Ore.

Buckets (Dumping)
Penn Fdy. & Mfg. Co., Reading, Pa.

Buckets (Elevator and Conveyor)
American Manganese Steel Co., Chicago Heights, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, Ohio
Smith Engineering Works, Milwaukee, Wis.
W. Toepfer & Sons Co., Milwaukee, Wis.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

Buckets (Grab, Clamshell, etc.)
Browning Co., Cleveland, Ohio
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, Ohio
Orton & Steinbrenner, Chicago, Ill.

Burr Mills
J. B. Ehrsam & Sons, Mfg. Co., Enterprise, Kan.

Cableways
Interstate Equipment Corp., New York, N. Y.

Calcining Kettles (Gypsum)
American Process Co., New York, N. Y.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.

Car Movers
Atlas Railway Supply Co., Chicago, Ill.

Car Pullers
Ottumwa Box Car Loader Co., Ottumwa, Iowa
Thomas Elevator Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

Cars (Quarry)
Koppel Ind. Car & Equipment Co., Koppel, Pa.
Penn Fdy. & Mfg. Co., Reading, Pa.
United Iron Works, Inc., Kansas City, Mo.

Cement (Insulating)
Celite Products Co., Chicago, Ill.

Chain (Steam Shovel)
Carroll Chain Co., Columbus, Ohio

Chain Drives
Link-Belt Co., Chicago, Ill.

Coal Pulverizing Equipment
Fuller-Lehigh Co., Fullerton, Pa.
K-B Pulverizer Co., New York City
Rubert M. Gay Co., New York, N. Y.
Pennsylvania Crusher Co., Philadelphia, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.

Conveyors and Elevators
Austin-Western Road Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, Ohio
Kennedy-Van Saun Mfg. & Engineering Corp., New York City
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Smith Engineering Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
W. Toepfer & Sons Co., Milwaukee, Wis.
United Iron Works, Inc., Kansas City, Mo.
Universal Crusher Co., Cedar Rapids, Iowa
Universal Road Mchy. Co., Kingston, N. Y.

Couplings
Knox Mfg. Co., Philadelphia, Pa.

Cranes (caterpillar)
Byers Machine Co., Ravenna, Ohio
Erie Steam Shovel Co., Erie, Pa.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, Ohio
McMyler Interstate Co., Cleveland, Ohio
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Osgood Co., Marion, Ohio
Thew Shovel Co., Lorain, Ohio

Cranes (Locomotive)
American Hoist & Derrick Co., St. Paul, Minn.
Browning Co., Cleveland, Ohio
Byers Machine Co., Ravenna, Ohio
Erie Steam Shovel Co., Erie, Pa.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
McMyler Interstate Co., Cleveland, Ohio
Northwest Engineering Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, Ohio
Orton & Steinbrenner, Chicago, Ill.
Osgood Co., Marion, Ohio
Thew Shovel Co., Lorain, Ohio

Cranes (Overhead Electric Traveling)
Morgan Engineering Co., Alliance, Ohio

Crushers (Hammer)
Jeffrey Mfg. Co., Columbus, Ohio
Pennsylvania Crusher Co., Philadelphia, Pa.

Crushers (Jaw and Gyratory)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Austin-Western Road Machinery Co., Chicago, Ill.
Earle C. Bacon, Inc., New York, N. Y.
C. G. Buchanan Co., New York City
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.
Rubert M. Gay Co., New York, N. Y.
Kennedy-Van Saun Mfg. & Engineering Corp., New York City.
Morgan Engineering Co., Alliance, Ohio
New Holland Machine Co., New Holland, Pa.
Pennsylvania Crusher Co., Philadelphia, Pa.
Smith Engineering Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
United Iron Works, Inc., Kansas City, Mo.
Universal Crusher Co., Cedar Rapids, Iowa
Universal Road Mchy. Co., Kingston, N. Y.
Webb City & Carterville Fdy. & Mch. Works, Webb City, Mo. (Jaw)
Worthington Pump & Mchy. Corp., New York

Crusher Protectors
Dings Magnetic Separator Co., Milwaukee, Wis.

Crushing Rolls
C. G. Buchanan Co., New York City
Kennedy-Van Saun Mfg. & Engineering Corp., New York
McLanahan Stone Mach. Co., Hollidaysburg, Pa.
New Holland Machine Co., New Holland, Pa.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
United Iron Works, Inc., Kansas City, Mo.
Webb City & Carterville Fdy. & Mch. Works, Webb City, Mo.
Worthington Pump & Mchy. Corp., New York

Derricks
McMyler Interstate Co., Cleveland, Ohio
Thomas Elevator Co., Chicago, Ill.

Dippers and Teeth (Steam Shovel)
American Manganese Steel Co., Chicago Heights, Ill.
Marion Steam Shovel Co., Marion, Ohio
Thew Shovel Co., Lorain, Ohio

Draglines
Erie Steam Shovel Co., Erie, Pa.
Marion Steam Shovel Co., Marion, Ohio
McMyler Interstate Co., Cleveland, Ohio
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Osgood Co., Marion, Ohio
Thew Shovel Co., Lorain, Ohio

Dragline Cableway Excavators
Browning Co., Cleveland, Ohio
Link-Belt Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.
Thomas Elevator Co., Chicago, Ill.

Dredge Chain
Carroll Chain Co., Columbus, Ohio

Dredges (Hydraulic)
Ellicott Machine Corp., Baltimore, Md.

Dredges (Sand and Gravel)
American Manganese Steel Co., Chicago Heights, Ill.
Ellicott Machine Corp., Baltimore, Md.
Marion Steam Shovel Co., Marion, Ohio
McMyler Interstate Co., Cleveland, Ohio
Morris Machine Works, Baldwinsville, N. Y.
Thomas Elevator Co., Chicago, Ill.

Drills (Air and Electric)
Howells Mining Drill Co., Plymouth, Pa

Drills (Blast Hole)
Howells Mining Drill Co., Plymouth, Pa.
Sanderson-Cyclone Drill Co., Orrville, Ohio

Drills (Hand)
Howells Mining Drill Co., Plymouth, Pa.

Drill Steel
Colonial Steel Co., Pittsburgh, Pa.

Dryers
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Process Co., New York, N. Y.
Buckeye Dryer Co., Chicago, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio
Kennedy-Van Saun Mfg. & Engineering Corp., New York, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

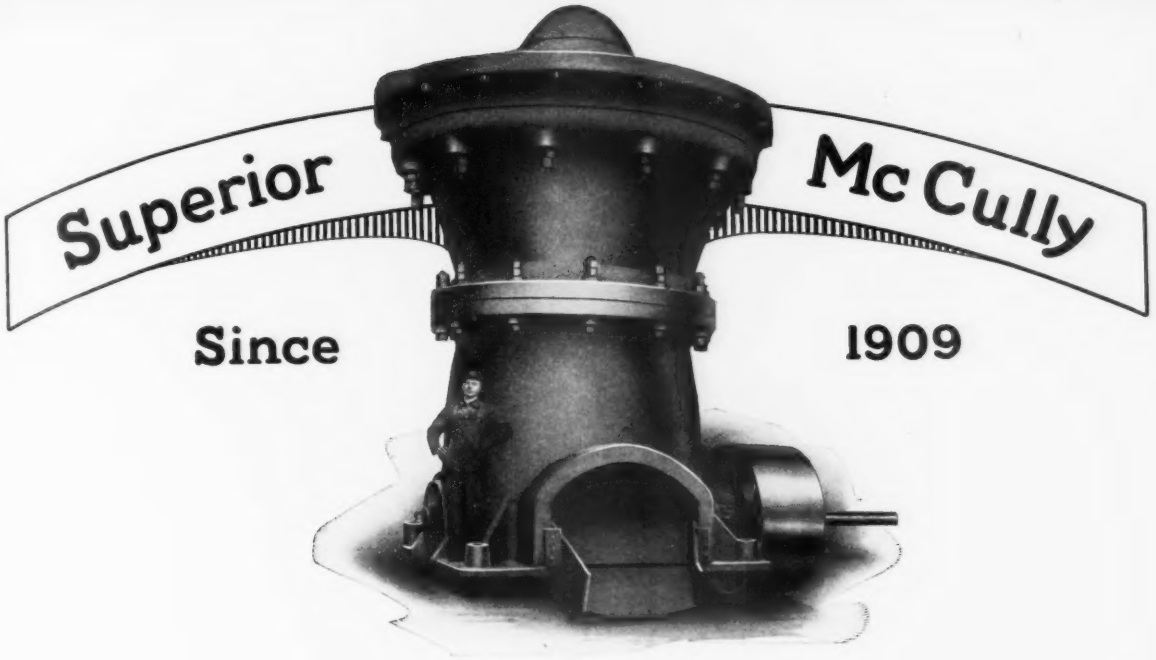
Engineers
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Robt. W. Hunt Co., Chicago, Ill.
Kritzer Co., Chicago, Ill.
Richard K. Meade & Co., Baltimore, Md.
H. Miscampbell, Duluth, Minn.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
F. L. Smidth & Co., New York, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Pa.

Engines (Gasoline, Kerosene and Oil)
American Hoist & Derrick Co., St. Paul, Minn.
Climax Engineering Co., Clinton, Iowa.
Worthington Pump & Mchy. Corp., New York

Engines (Steam)
American Hoist & Derrick Co., St. Paul, Minn.
Ellicott Machine Corp., Baltimore, Md.
Jackson & Church Co., Saginaw, Mich.
Morris Machine Works, Baldwinsville, N. Y.

Frogs and Switches
Central Frog & Switch Co., Cincinnati, Ohio
Koppel Ind. Car & Equipment Co., Koppel, Pa.

Fuses (Detonating and Safety)
Ensign-Bickford Co., Simsbury, Conn.



Worthington Built
The Original Superior McCully

In 1909 Worthington built the first short shaft gyratory called the Superior McCully Crusher as distinguished from the standard McCully. Thus the present style of gyratory crusher built at the Power and Mining Works of the Worthington Pump and Machinery Corporation has a background of fourteen years.

WORTHINGTON PUMP AND MACHINERY CORPORATION
Executive Offices: 115 Broadway, New York City. Branch Offices in 24 Large Cities

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Deane Works, *Holyoke, Mass.*
Blake & Knowles Works
East Cambridge, Mass.
Worthington Works
Harrison, N. J.
Laidlaw Works, *Cincinnati, Ohio.*

Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works
Cudahy, Wis.
Snow-Holly Works
Buffalo, N. Y.

When writing advertisers please mention ROCK PRODUCTS

Buyers' Directory
of the Rock Products Industry

Classified Directory of Advertisers in this issue of Rock Products

Gas Producers
Chowning Regulator Corp., Corning, N. Y.
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Morgan Construction Co., Worcester, Mass.

Gas Producer Regulators
Chowning Regulator Corp., Corning, N. Y.

Gears (Spur, Helical, Worm)
The Falk Corp., Milwaukee, Wis. (Helical)

Grease
Keystone Lubricating Co., Philadelphia, Pa.

Grizzlies
Robins Conveying Belt Co., New York City
W. Toepfer & Sons Co., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.

Gypsum Plaster Plants
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.

Hoists
American Hoist & Derrick Co., St. Paul, Minn.
Hyman-Michaels Co., Chicago, Ill.
Industrial Works, Bay City, Mich.
Jackson & Church Co., Saginaw, Mich.
Thomas Elevator Co., Chicago, Ill.
United Iron Works, Inc., Kansas City, Mo.
Vulcan Iron Works, Wilkes-Barre, Pa.
Weller Mfg. Co., Chicago, Ill.

Hose (Water, Steam, Air Drill)
New York Belting & Packing Co., New York City

Hydrators (Lime)
Kritzer Co., Chicago, Ill.
Richard K. Meade & Co., Baltimore, Md.
H. Miscampbell, Duluth, Minn.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

Insulation (Heat)
Celite Products Co., Chicago, Ill.

Kilns (Rotary)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Kennedy-Van Saun Mfg. & Engineering Corp., New York City
H. Miscampbell, Duluth, Minn.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

Kilns (Shaft)
H. Miscampbell, Duluth, Minn.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

Lime Handling Equipment
H. W. Caldwell & Son, Chicago, Ill.
Kritzer Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
H. Miscampbell, Duluth, Minn.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Sturtevant Mill Co., Boston, Mass.
Webster Mfg. Co., Chicago, Ill.

Lime Kilns
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.

Liquid Fuel Equipment
W. N. Best Corp., New York City

Loaders and Unloaders
Hoar Shovel Co., Duluth, Minn.
Jeffrey Mfg. Co., Columbus, Ohio
Link-Belt Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, Ohio
McMyler Interstate Co., Cleveland, Ohio
Northwest Engineering Co., Chicago, Ill.
Ottumwa Box Car Loader Co., Ottumwa, Iowa

Locomotives (Steam, Gas and Elec.)
Baldwin Loco. Wks., Phila., Pa. (Steam)
Fate-Root-Heath Co., Plymouth, Ohio (Gas)
Ironton Eng. Co., Ironton, Ohio (Elec.)
Jeffrey Mfg. Co., Columbus, Ohio (elec.)
Lima Locomotive Works, Lima, Ohio (Steam)
Milwaukee Loco. Mfg. Co., Milwaukee, Wis. (Gas)
H. K. Porter Co., Pittsburgh, Pa. (Steam)
Vulcan Iron Works, Wilkes-Barre, Pa. (Steam)

Lubricating Systems
Keystone Lubricating Co., Philadelphia, Pa.
Ottumwa Box Car Loader Co., Ottumwa, Iowa

Magnetic Devices (Pulleys, etc.)
Dings Magnetic Separator Co., Milwaukee, Wis.

Manganese Steel (Castings, Repairs, etc.)
American Manganese Steel Co., Chicago Heights, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio

Mills, Grinding (Ball, Tube, etc.)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jackson & Church Co., Saginaw, Mich.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
F. L. Smidth & Co., New York, N. Y.
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Traylor Eng. & Mfg. Co., Allentown, Pa.
Worthington Pump & Mchy. Corp., New York

Motors and Generators
Burke Electric Co., Erie, Pa.

Oil Burners and Systems
Smokeless Oil Burner Co., Bucyrus, Ohio

Packing (Pump Valves, etc.)
New York Belting & Packing Co., New York City

Perforated Metal
Cross Engineering Co., Carbondale, Pa.
Harrington & King Perforated Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
W. Toepfer & Sons Co., Milwaukee, Wis.

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Jeffrey Mfg. Co., Columbus, Ohio

Portable Engines
Climax Engineering Co., Clinton, Iowa

Power Units
Climax Engineering Co., Clinton, Iowa

Pulleys (Magnetic)
C. G. Buchanan Co., New York City
Magnetic Mfg. Co., Milwaukee, Wis.

Pulverizers
Fuller-Lehigh Co., Fullerton, Pa.
Jeffrey Mfg. Co., Columbus, Ohio
K-B Pulverizer Co., Inc., New York City
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Universal Crusher Co., Cedar Rapids, Iowa

Pumps (Sand and Gravel)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Heights, Ill.
Ellicott Machine Corp., Baltimore, Md.
Morris Machine Works, Baldwinsville, N. Y.

Pumps (Water, etc.)
Morris Machine Works, Baldwinsville, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Smokeless Oil Burner Co., Bucyrus, Ohio
Webb City & Carterville Fdy. & Mch. Works, Webb City, Mo.
Worthington Pump & Mchy. Corp., New York

Pump Valve (Rubber)
New York Belting & Packing Co., New York City

Rails
Koppel Ind. Car & Equipment Co., Koppel, Pa.

Railway Supplies
Atlas Railway Supply Co., Chicago, Ill.

Road Machinery
Austin-Western Road Machinery Co., Chicago, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio
Marion Steam Shovel Co., Marion, Ohio
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Universal Road Mchy. Co., Kingston, N. Y.

Scrapers (Drag, etc.)
Austin-Western Road Machinery Co., Chicago, Ill.
Northwest Engineering Co., Chicago, Ill.
Thomas Elevator Co., Chicago, Ill.

Screens
Austin-Western Road Machinery Co., Chicago, Ill.
Earle C. Bacon Co., New York, N. Y.
Cross Engineering Co., Carbondale, Pa.
Rubert M. Gay Co., New York, N. Y.
Harrington & King Perforating Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Kennedy-Van Saun Mfg. & Engineering Corp., New York City
Link-Belt Co., Chicago, Ill.
McLanahan Stone Mach. Co., Hollidaysburg, Pa.
Newark Wire Cloth Co., Newark, N. J.
Robins Conveying Belt Co., New York City
Smith Engineering Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
W. Toepfer & Sons Co., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.
W. S. Tyler Co., Cleveland, Ohio
United Iron Works, Inc., Kansas City, Mo.
Universal Crusher Co., Cedar Rapids, Iowa
Weller Mfg. Co., Chicago, Ill.

Screens (Electric Vibrating)
W. S. Tyler Co., Cleveland, Ohio

Separators (Magnetic)
C. G. Buchanan Co., New York City
Dings Magnetic Separator Co., Milwaukee, Wis.
Magnetic Mfg. Co., Milwaukee, Wis.

Shafting
H. W. Caldwell & Son, Chicago, Ill.

Shovels (Steam, Gas and Electric)
Browning Co., Cleveland, Ohio
Erie Steam Shovel Co., Erie, Pa.
Marion Steam Shovel Co., Marion, Ohio
McMyler Interstate Co., Cleveland, Ohio
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Osgood Co., Marion, Ohio
Thew Shovel Co., Lorain, Ohio

Sprockets and Chain
American Manganese Steel Co., Chicago Heights, Ill.
H. W. Caldwell & Son Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, Ohio

Steel Plate Construction
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Hendrick Mfg. Co., Carbondale, Pa.
Jackson & Church Co., Saginaw, Mich.

Testing Sieves and Shakers
Newark Wire Cloth Co., Newark, N. J.
W. S. Tyler Co., Cleveland, Ohio

Tool Steel
Colonial Steel Co., Pittsburgh, Pa.

Track Equipment
Central Frog & Switch Co., Cincinnati, Ohio
Koppel Ind. Car & Equipment Co., Koppel, Pa.

Tramways (Aerial Wire Rope)
Interstate Equipment Corp., New York City
A. Leschen & Sons Rope Co., St. Louis, Mo.

Transmission Machinery
H. W. Caldwell & Son Co., Chicago, Ill.
Kritzer Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

Underground Loaders
Thew Shovel Co., Lorain, Ohio

Valves (Throttle)
Knox Mfg. Co., Philadelphia, Pa.

Washers (Sand, Gravel and Stone)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., Chicago, Ill.
McLanahan Stone Mach. Co., Hollidaysburg, Pa
Smith Engineering Works, Milwaukee, Wis.

Weighing Equipment
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

Welding Equipment
Burke Electric Co., Erie, Pa.

Wheels (Car)
Koppel Ind. Car & Equipment Co., Koppel, Pa.

Wire Cloth
Newark Wire Cloth Co., Newark, N. J.
W. S. Tyler Co., Cleveland, Ohio

Wire Rope
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PERFORATED STEEL SCREENS

You can always get a better understanding of the advantages of Cross Perforated Steel Screen if you will talk to users.

There are hundreds and hundreds of them and the service they enjoy is uniformly excellent.

500 tons or more of steel plates and sheets are carried in stock. This enables us to fill rush orders promptly.

Repair and renewal parts supplied quickly and correctly.

Write for prices and information

Cross Engineering Company, Offices and Works, Carbondale, Pa.

Locomotives of Merit

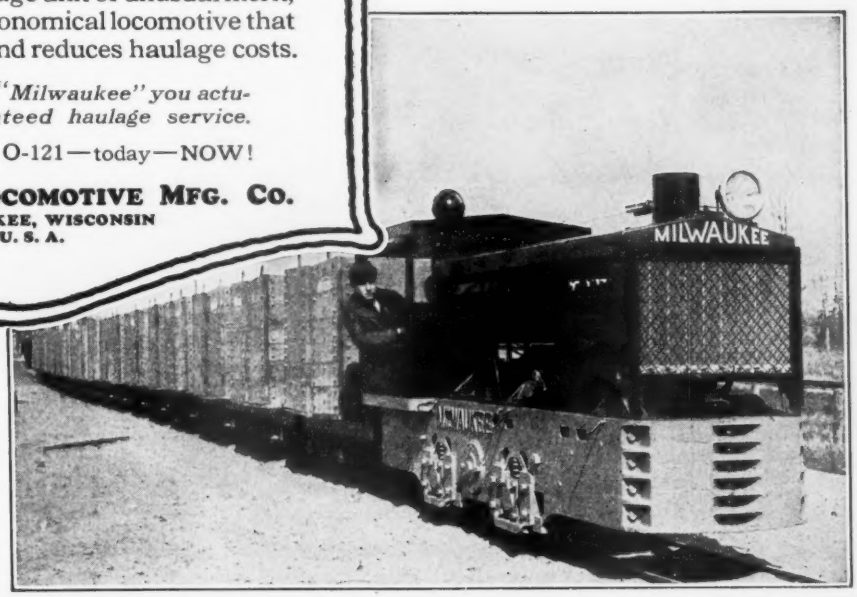
The increasing number of contractors, road builders and industrial concerns *now* using Milwaukee Gasoline Locomotives *exclusively*, merely proves that they have found in the "Milwaukee" a haulage unit of unusual merit, a dependable and economical locomotive that speeds up the jobs and reduces haulage costs.

When you buy a "Milwaukee" you actually buy guaranteed haulage service.

Write for Catalog O-121—today—NOW!

MILWAUKEE LOCOMOTIVE MFG. CO.
MILWAUKEE, WISCONSIN
U. S. A.

MILWAUKEE GASOLINE LOCOMOTIVES



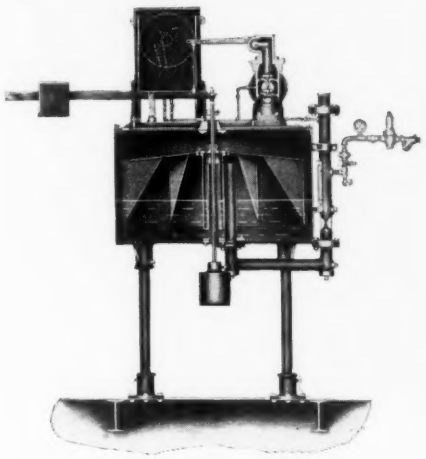
You'll never know how much real value can be built into a locomotive until you learn more about the "Milwaukee."

THE STABILIZER

The Chowning Regulator may well be called a "Stabilizer" or "Shock-absorber."

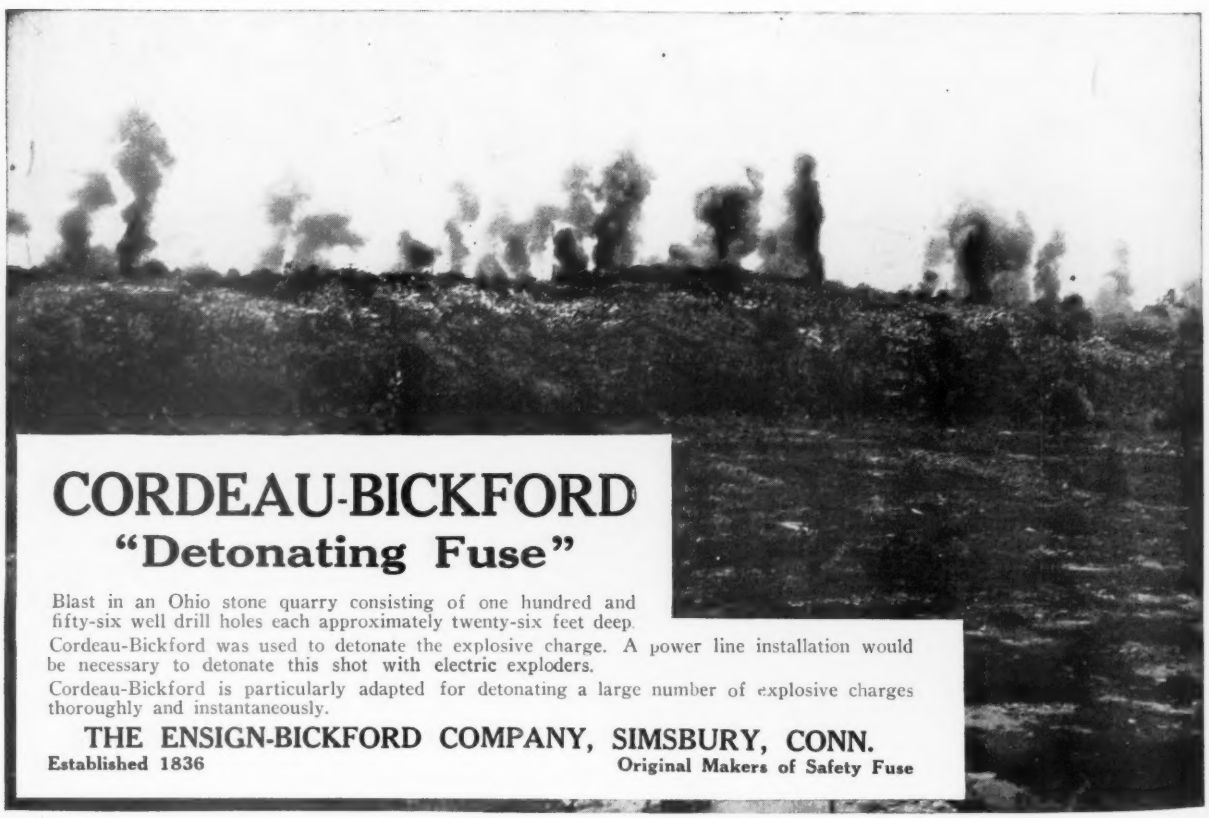
Gas is maintained in a steady, even pressure range that gives a very close temperature range. The Chowning takes care of any sudden or uneven pressure smoothing the road for better and more economic results from your Kilns.

Actual use in operation proves that you need a Chowning Regulator if you use a Gas Producing Machine.



Sectional View of Chowning Regulator

Chowning Regulator Corporation
CORNING, N. Y.



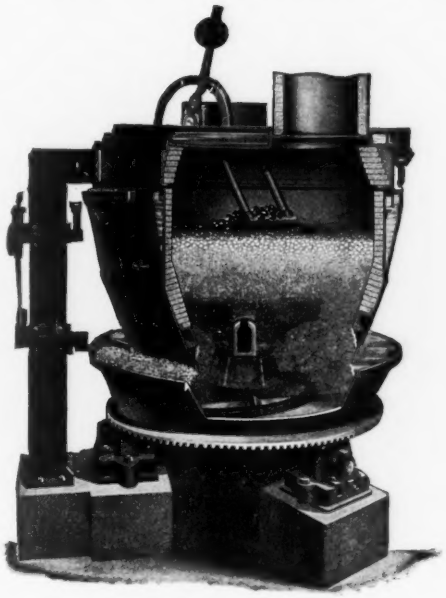
CORDEAU-BICKFORD
"Detonating Fuse"

Blast in an Ohio stone quarry consisting of one hundred and fifty-six well drill holes each approximately twenty-six feet deep. Cordeau-Bickford was used to detonate the explosive charge. A power line installation would be necessary to detonate this shot with electric exploders.

Cordeau-Bickford is particularly adapted for detonating a large number of explosive charges thoroughly and instantaneously.

THE ENSIGN-BICKFORD COMPANY, SIMSBURY, CONN.
Established 1836 Original Makers of Safety Fuse

The Machine of Absolute Satisfaction



Selected by every large purchaser in the steel industry since the armistice. Three recent installations at leading Eastern Lime Plants.

POKERLESS PRODUCER-GAS MACHINE

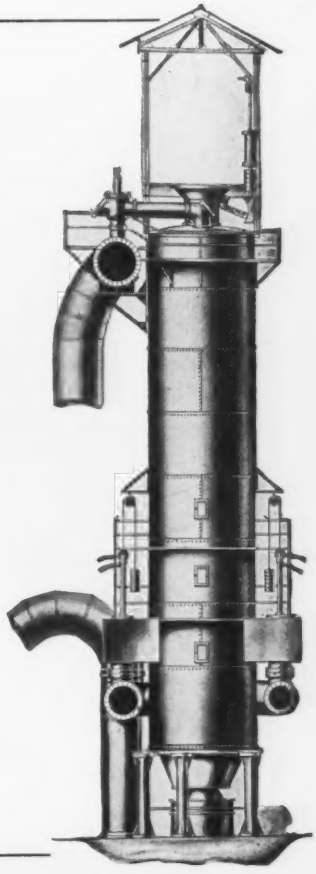
Users everywhere testify with one voice to the superior satisfaction and low maintenance expense of this splendid machine. Difference in first cost comes back annually; every detail built for endurance.

MORGAN CONSTRUCTION CO.
Worcester, Mass.
W. D. Mount, 601 Peoples National Bank Bldg., Lynchburg, Va., Representative in the Lime Industry

Continuous Discharge—Gas Fired
LIME KILNS

The wastefulness of efficiency of any lime burning apparatus is determined by the amount of fuel per ton of lime produced.

Our Kilns are not an experiment, but have successfully met the test of years of actual service. The design is the work of our Consulting Mechanical and Chemical Engineer, who has had many years of practical operative experience. They embody a number of labor saving devices, and are designed to secure maximum production with minimum fuel consumption; their record in this respect should interest every lime producer in the country.



Glamorgan Pipe & Foundry Company
Lynchburg, Va., U. S. A.
Using the Nationally Famous Virginia Foundry Irons

What the Shay Will Do

"We have a Shay Geared Locomotive, and we believe and know that it is the best and surest power on the market. It is very economical in operation. It will cling to the roughest track. It will handle a larger tonnage than any other kind of power on the market today."

The above was written by a Shay owner. It sums up briefly what a number of quarry men have known for years—that for steady, heavy hauling, under the most severe logging conditions, there is no locomotive like a Shay.

If you are moving rock with heavy, unsuitable rod engines, you have an excellent opportunity to reduce your hauling costs. Put a Shay to work on that job. Note how much more you can haul in the same time, and at how much lower cost. Complete information about the Shay on request.

LIMA LOCOMOTIVE WORKS
Incorporated
Lima, Ohio 17 East 42nd St., New York

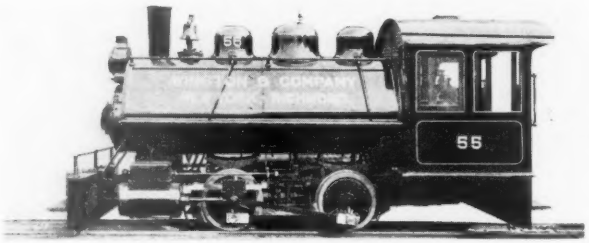
LIMA *Shay Geared* LOCOMOTIVES

IMMEDIATE SHIPMENT

ON

New Vulcan Locomotives

of the Four-Coupled, Saddle Tank, "Industrial or Contractor's" Type



Size Cylinders	11x16"
Gauge	36"
Service Weight	41,000 lbs.
Tractive Force	9,170 lbs.

We offer, subject to prior sale, the following new VULCAN Locomotives, from stock:

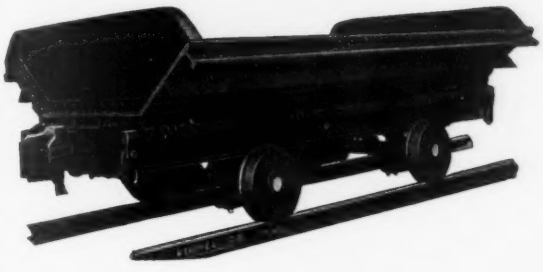
1—10x16" Cylinders, 36" Gauge, Service Weight, 39,000 lbs., Tractive Force, 7,580 lbs.
3—11x16" Cylinders, 36" Gauge, Service Weight, 41,000 lbs., Tractive Force, 9,170 lbs.
1—11x16" Cylinders, 56½" Gauge, Service Weight, 42,500 lbs., Tractive Force, 9,170 lbs.
1—12x16" Cylinders, 56½" Gauge, Service Weight, 52,000 lbs., Tractive Force, 10,085 lbs.
1—13x20" Cylinders, 56½" Gauge, Service Weight, 68,000 lbs., Tractive Force, 14,365 lbs.
1—14x22" Cylinders, 56½" Gauge, Service Weight, 82,000 lbs., Tractive Force, 18,325 lbs.
(Having Fuel Bunker at Rear of Cab)

Write or Wire Us

VULCAN IRON WORKS, Designers and Builders, Wilkes-Barre, Pa.

KOPPEL ECONOMY—EFFICIENCY KOPPEL

You're sure of both when you equip your quarry with Koppel Cars and Track



Koppel Quarry Cars are built to stand the strain and hard usage of severe service.

Koppel Track, Switches and Frogs are designed right, and they're built right.

Let us solve your Hauling Problems

KOPPEL INDUSTRIAL CAR & EQUIPMENT COMPANY

Koppel, Pennsylvania

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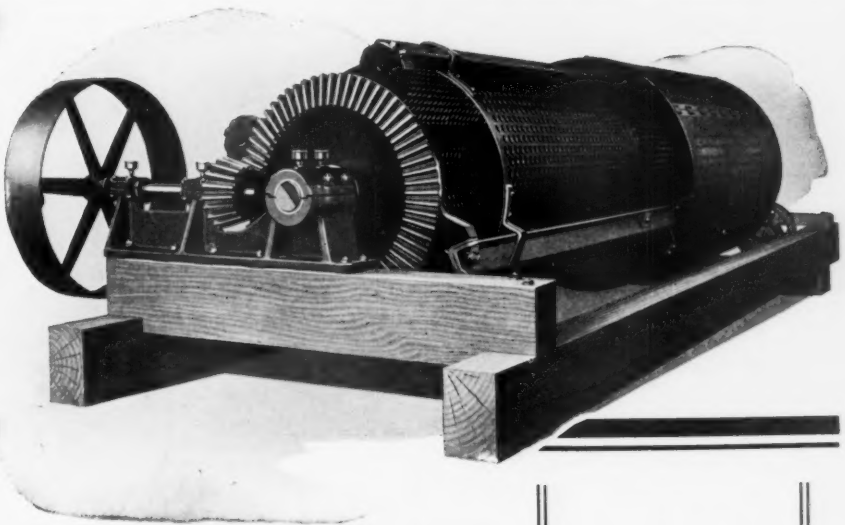
The TOEPFER SCREENS



Toepfer Screens are always built with the highest grade of materials, assuring durability and a continuous service performance that develops an unusual degree of operating economy.

They are heavy screens, made in several sizes. The head ring at the receiving end is cast steel, running on chilled rollers. The gear head and main bearing are cast in one piece.

Send for our Catalog

W. Toepfer & Sons Co., Milwaukee, Wisconsin

We Also Manufacture:

Elevators, Sand Washers, Washing Screens, Grizzlys, Feeders, Conveyors, Bin Gates, Perforated Metals.

WELLER-MADE EQUIPMENT

For Handling the Materials Mechanically

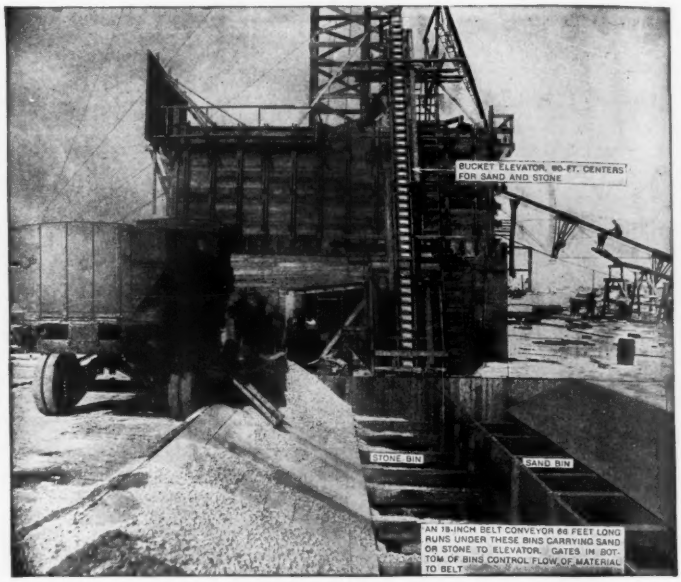
Increase the Output and Reduce Costs by Employing Weller-Made Machinery to Do the Work

It is sturdy and reliable. Never lays down on the job. The cost of operation is small. Will help pay dividends.

We Make
Conveyors of All Types

Bucket Elevators	Portable Elevators
Steel Storage Bins	Bin Gates
Screens	Sheet Metalwork, etc.

Write and let us know the kind of equipment you are interested in or the material you want to handle. Catalogues showing installations, also data to help in selection of equipment, will be sent.


BUCKET ELEVATOR, 90-FT. CENTERS FOR SAND AND STONE
STONE BIN
SAND BIN
AN 18-INCH BELT CONVEYOR 66 FEET LONG RUNS UNDER THESE BINS CARRYING SAND OR STONE TO ELEVATOR. GATES IN BOTTOM OF BINS CONTROL FLOW OF MATERIAL TO BELT

WELLER MFG. CO.

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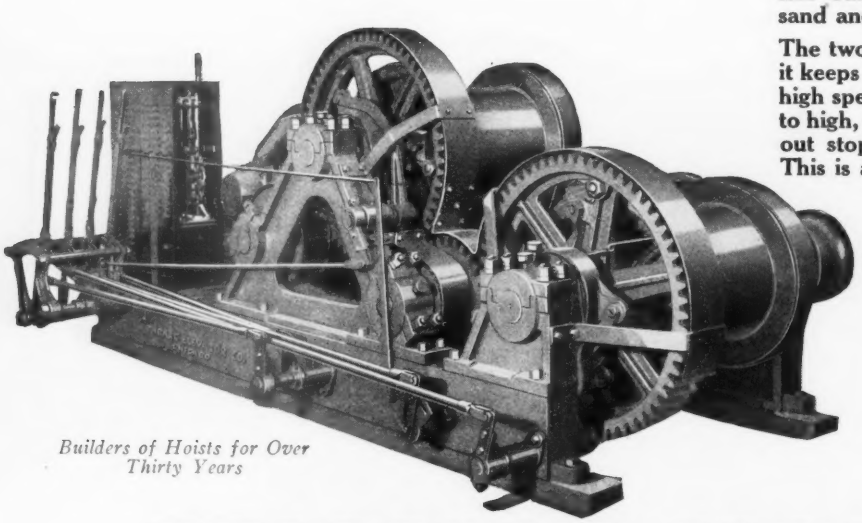
Specialized Hoists for Sand and Gravel



Builders of Hoists for Over Thirty Years

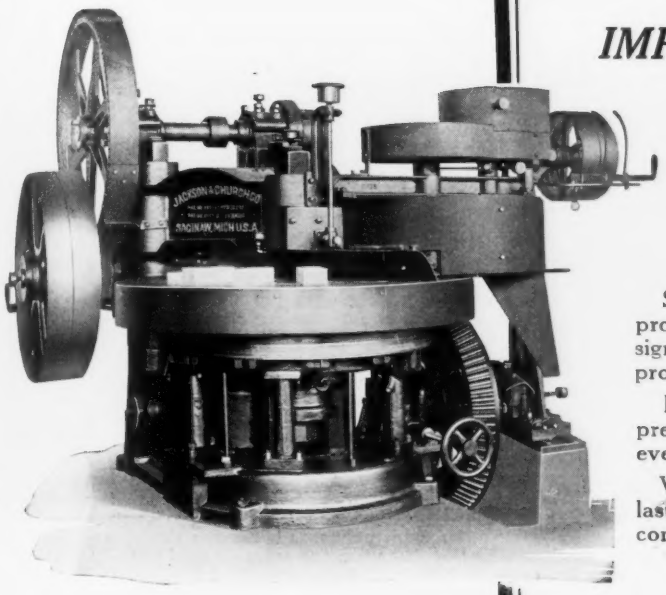
The Thomas Two-Speed Electric Slackline Cableway Hoist is an ideal hoist for sand and gravel.

The two speed device is so designed that it keeps pulling in the slow speed until the high speed takes effect; the shift from low to high, and vice-versa, can be made without stopping the rotation of the drums. This is an exclusive Thomas feature.

Ask for Bulletin No. 33

Thomas Elevator Company
27 South Hoyne Avenue
Chicago

THOMAS HOISTS



IMPROVED TYPE "A"

SAND-LIME BRICK PRESS

Some of our directors are not only large producers of sand-lime brick, but have designed and constructed many plants for other producers.

Personally, we think so much of the rotary press shown here that we have supplied it to every plant we have built.

We consider this Type "A" press to be the last word in design, grade of material, care in construction, and degree of efficiency.

Write for complete information.

We also manufacture Hydrators, Kettles, Rod Mills, Wet Pans, Transfer Cars, Turntables, Hardening Cars, Sand Scrapers and Volumeters.

We also design and complete plants.

JACKSON & CHURCH company

SAND LIME BRICK MACHINERY

SAGINAW, MICH. U. S. A.

Replaces a Whole Loading Gang—

Unskilled labor is scarce—why not put your loading gang on more productive work? An Ottumwa Loader will replace a whole loading gang in your plant and at a lower cost. It will increase your tonnage and cut down your overhead expense. The Ottumwa Loader is always on the job ready for work.

The Ottumwa Loader is operated by a 2 or 3 h.p. gasoline engine or electric motor. It is protected from dust and dirt and has quick raising and lowering device for adjusting delivery. Roller and ball bearings used throughout. Uses latest improved Alemite Greasing System. Carries its belt on rollers to reduce power consumption to minimum.

Put an Ottumwa Loader to work! For Sand and Gravel, Crushed Rock, Bulk Lime, Silica, Phosphate, Clay, Ores, Small Coal, etc.

Backed by 25 Years' Loading Experience

TELL US YOUR PROBLEM

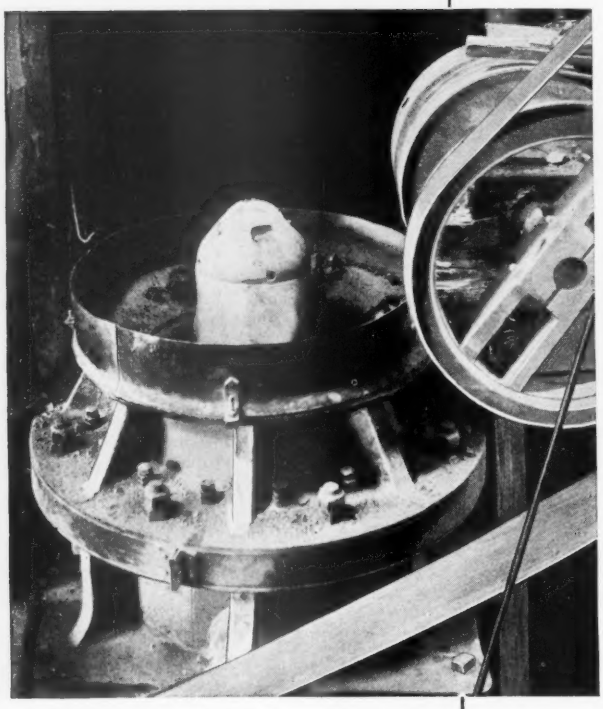
ENGINEERING SERVICE

FREE

MANUFACTURERS

OTTUMWA BOX CAR LOADER COMPANY, OTTUMWA IOWA.

BEST BOX CAR LOADERS AND UNLOADERS



TELSMITH

TAKES CHOKE FEED OF COARSE ROCK—

Feed him with a spoon? No sir—nor with an automatic feeder either! Carefully sized feed? Not on your life, old man! This Telsmith Re-crusher has two huge feed openings and a big open crushing bowl. Telsmith will take ordinary run-of-crusher rock (with fines removed) just as it comes, without bridging or clogging. If the rock shoots in too fast for a while, let it pile up in the hopper. Telsmith will work his way out from under a ten foot column of big rock with bolts tight, oil cool, bearings smooth. Telsmith is ***built*** for a choke-feed and does his best work when loaded to the muzzle.

Tramp iron? It will bother you very little. The outer structure of this machine is ***steel,*** guaranteed against breakage by tramp iron. The back-bone is the famous Telsmith bolt-shaft, likewise guaranteed against breakage by tramp iron. Drill points and hammer heads may be released by slacking upon the main frame bolts. So we say—***play safe.*** Install the no-worry Telsmith Re-crusher. Glad to send you bulletin No. 2F11 (Telsmith Reduction Crusher) and Catalog No. 166 (Telsmith Primary Breaker).

SMITH ENGINEERING WORKS
3188 Locust Street Milwaukee, Wis., U. S. A.

Canadian Representatives:
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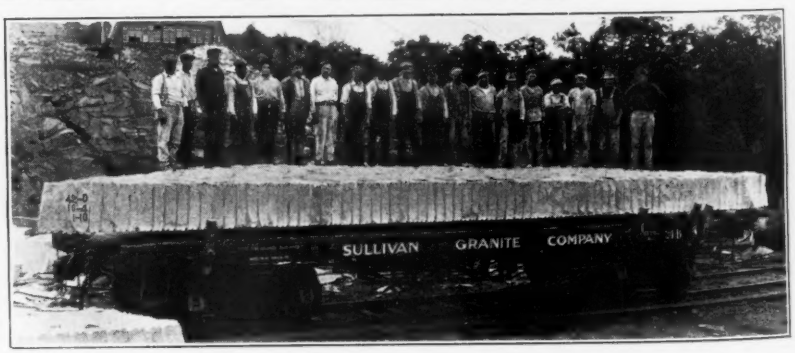
VANADIUM
RED STAR
DRILL STEEL

THE keen cutting qualities, the long lasting durability, of Red Star Vanadium makes it the Drill Steel for fast work —and for economy, too.

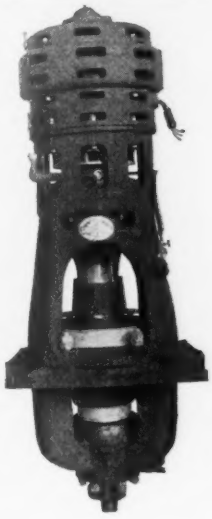
Vanadium toughness and strength reduce drill bit breakage. On your next order specify Red Star VANADIUM. It is in stock at our warehouses.



Colonial Steel Company

Pittsburgh Boston New Haven New York Cleveland Cincinnati
Detroit Chicago St. Louis Denver Salt Lake City Phoenix Wallace, Idaho
Edw. L. Soule Co., San Francisco

The Weston Direct Drive Gyratory Crusher for Secondary Reduction of Hard Rock, Ore and Gravel



Developed in a Granite Crushing Plant

This machine fills the need for a secondary crusher of large capacity and great strength for work in all friable rock.

The first machine, installed more than two years ago, has established remarkable records for capacity, low power consumption and general economy in operation. Later installations have more than proved all claims for the machine.

The construction is all-steel with Chrome-Vanadium forged steel shaft of large size, and with full-bearing eccentric, bronze bushed inside and out.

The entire machine is arranged to give freedom from costly delays. Positive lubrication without pumps—Dust prevention in bearings—Greater wear on manganese before replacement—Ease of adjustment and repair—and a sturdy oversize motor—All work to your advantage.

Crusher is simple in design and the best practice in modern Engineering is utilized. Built in six standard sizes to follow any primary, smallest machine can be set to ½" with large capacity.

Arranged for direct motor, or belt drive.

Bulletin No. 25-A describes this machine in detail

THE MORGAN ENGINEERING COMPANY
ALLIANCE, OHIO

Designers, Manufacturers and Contractors
Electric Traveling Cranes, Rolling Mill Machinery
Ordnance, Steel, Shipbuilding and Forging Plants Complete
Rock Crushers, Special Machinery for Any Purpose

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Please send me catalogs and prices concerning the following items:

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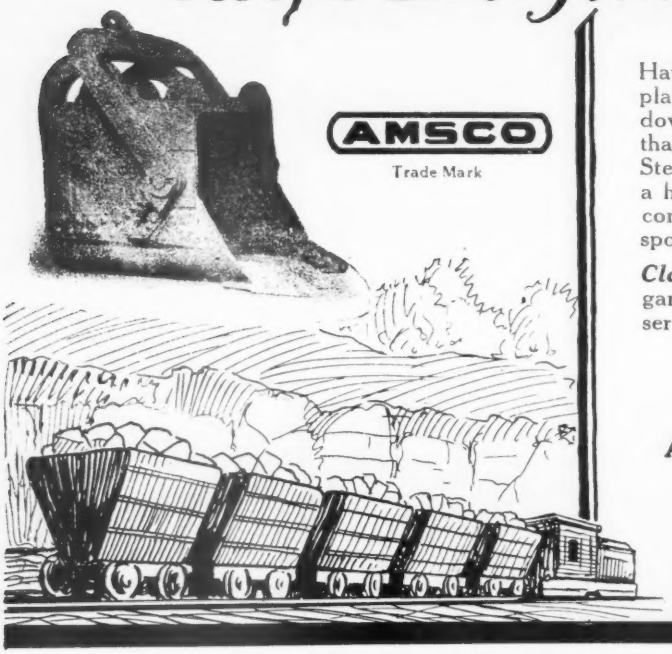
The MISSABE DIPPER
Keeps Everything Moving



Have you ever visited a quarry when the whole plant was standing idle because of a broken down dipper? If you have, it wasn't a Missabe that's sure. The Missabe is built of Manganese Steel, the most enduring of all metals. It has a habit of delivering the goods. Durability—continuous performance day after day is responsible for the success of the Missabe Dipper.

Clark Reversible Dipper Teeth built of Manganese Steel will give you unthought of service.

Ask for our exchange proposition on Dipper Teeth

AMERICAN MANGANESE STEEL COMPANY

General Sales Office:
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FOUNDRIES: Chicago Heights, Ill.; New Castle, Del., and Oakland, Calif.

AUGER DRILLS AUGER DRILLS

Heavy Duty Post Drills

Bore Faster and Cheaper

Requires but a few seconds to adjust the Post and Howells Heavy Geared Post Drill is ready to bore Slate Shale, Gypsum, Fire Clay, etc. Geared to withstand the strength of two to four men.

Portable Electric Drills and Two Men Electric Drills arranged in various ways to suit your mining conditions. STEEL AUGERS made any size and any length required.

Howells Mining Drill Company
Established 1878 **Plymouth, Pa.**

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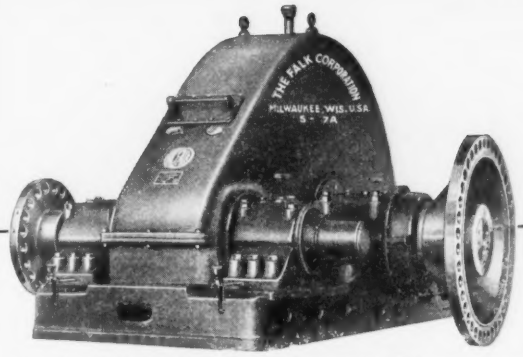

Falk Type S Herringbone Gear Unit—overall efficiency 99 per cent when running at full speed under rated load. Gears enclosed for protection against abrasive dust.

SAVINGS—the Fruit of Experience

The finest thing The Falk Corporation has to offer the user of power is the opportunity to save money and enjoy better service in the operation of power plants.

Economy for the user of power has been our objective — economy of power saved and utilized—the economy of longer service—the economy of avoiding repair delays—the economy of greatly reduced replacement costs.

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Ask us how they may be used to advantage on your grinding and pulverizing machinery.

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MANGANESE
THE FIRST ERA STILL LEADS IN QUALITY
STEEL
THE HADFIELD-PENFIELD STEEL COMPANY
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of endurance

We have yet to hear of a dissatisfied user of Era Manganese Steel Repair parts.

Their strength, their reliable and trouble-free service record has given them an enviable reputation that is worthy of your consideration.

We will gladly quote on your requirements

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SMOOTH running; correct in design, accurate and true to pitch, Caldwell gears are bound to please you. We make all types—machine-molded, cut tooth, mortise gears, worm gears, etc. Learn more about Caldwell-Link-Belt Service.

Let us figure with you next time you are in the market.

H. W. CALDWELL & SON CO. LINK-BELT COMPANY, OWNER
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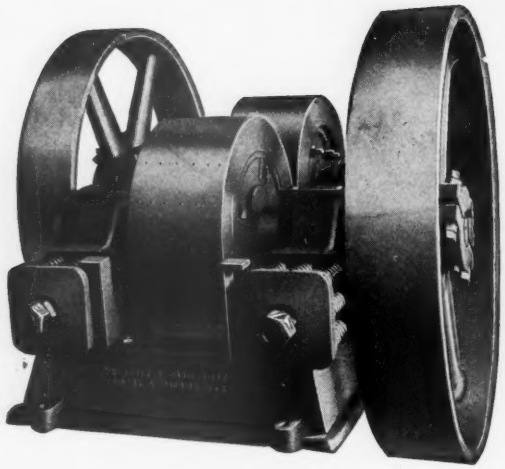
CALDWELL



CRUSHERS—

Webb City & Carterville crushers, screens, elevator buckets, or transmission equipment have conspicuously demonstrated their superiority wherever they have been installed.

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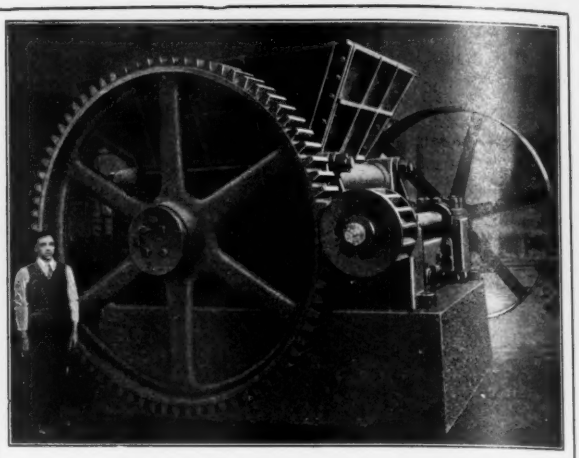
WEBB CITY & CARTERVILLE FOUNDRY & MACHINE WORKS
WEBB CITY, MISSOURI

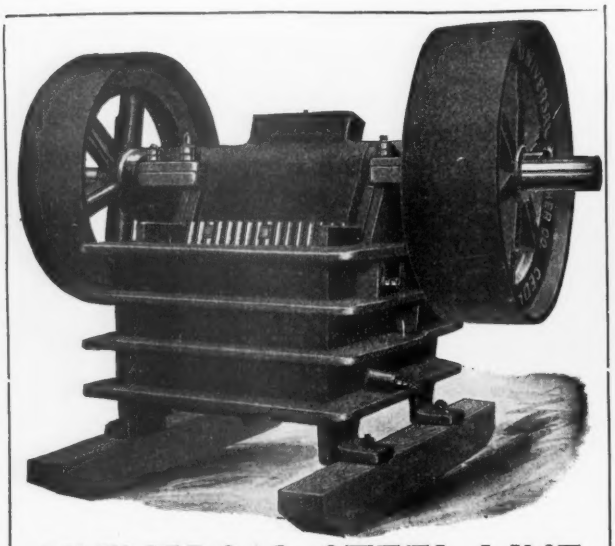


If you had seen the McLanahan Single Roll Crusher before ordering your first Gyratory or Jaw Crusher, you would now be running only the McLanahan Crushers.

After many years' practical experience building and operating other crushers, we brought out the first Single Roll Crusher, proved it best, simplest and most economical—making least fines—requires but little head room—no apron or hand feeding—takes wet or slimy material.

Capacity, 5 to 500 Tons Per Hour

McLanahan-Stone Machine Co.
Hollidaysburg, Pa.
Screens, Elevators, Conveyors, Rock Washers, Etc.



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THE PERFECT GRAVEL AND REJECTION CRUSHER

Sizes up to 8"x36". Capacities 20 to 200 tons daily. Crushes to ¾" and finer if desired. Has no superior for FINE CRUSHING and UNIFORMITY of product.

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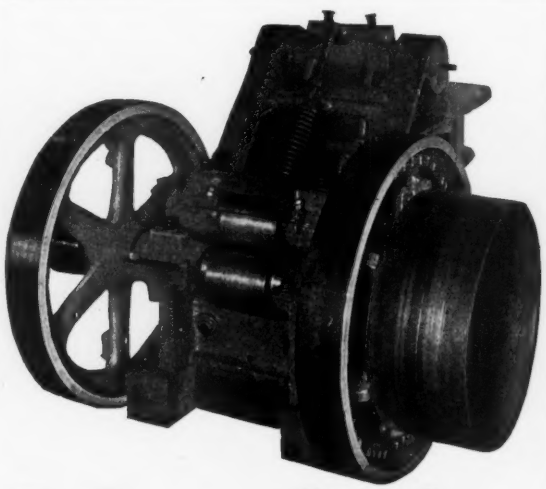
UNIVERSAL CRUSHER CO.
225 Third Street Cedar Rapids, Iowa, U. S. A.



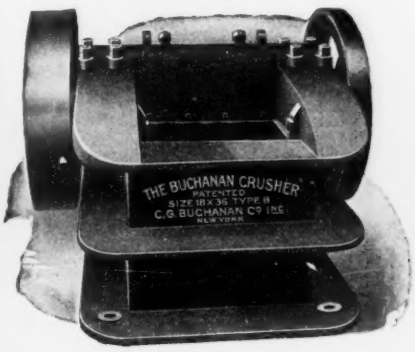
Reliance Crushers

IN ALL SIZES FOR EITHER PORTABLE PLANTS FOR ROAD BUILDING OR STATIONARY QUARRY INSTALLATIONS.

BUILT FOR LONG, HARD SERVICE—WILL SAVE YOU MONEY IN THE LONG RUN

Let us quote you prices

Universal Road Machinery Co., Kingston, N. Y.
Branches in all principal cities in U. S. and Canada
MANUFACTURERS OF THE FAMOUS RELIANCE LINE OF ROAD BUILDING AND QUARRY EQUIPMENT



BUCHANAN ALL-STEEL CRUSHER

Type "B" Jaw Crusher

Frame is a solid casting of open-hearth steel in one piece having a tensile strength of from 60,000 to 65,000 lb. per square inch, three or four times stronger than cast iron and with at least three or four times the rigidity of the built-up rolled steel-plate crusher.

Jaw and Cheek Plates are of the best Manganese Steel, made reversible for double wear—Adjustable Jaw Stroke—Shim Adjustment—Safety Toggle—Reversible Steel Toggle Seats—Phosphor Bronze Frame Bearings (in smaller sizes)—Steel Swing Jaw and Pitman—Pitman water jacketed and parting in large sizes.

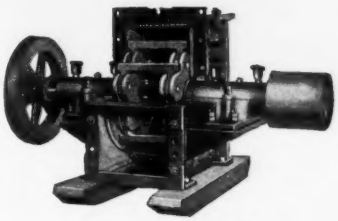
Built in sizes up to 18"x36".

Large Crushers, Crushing Rolls, Complete Crushing Plants

Write for Bulletin No. 9

C. G. BUCHANAN COMPANY, Inc.

Cedar and West Streets, New York City



Manganese Steel Linings

USERS OF "K-B" PULVERIZERS

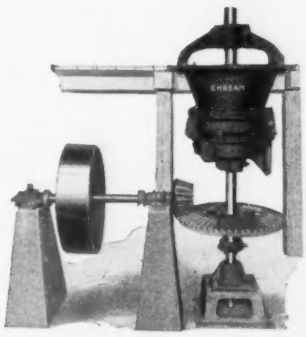
requiring additional tonnage are ordering "K-B" equipment.

May we tell you why?

K-B PULVERIZER

K-B Pulverizer Co., Inc.
92 Lafayette Street
New York

EHRSAM
Rotary Crushers



These crushers are furnished in four sizes. Top diameter of bowls: 20-in., 28-in., 36-in., and 42-in., with capacities of from 5 to 60 tons per hour.

Ehrsam Rotary Crushers insure uninterrupted service. They are Ehrsam products correctly designed and constructed for efficiency and economy.

Our Gypsum Plaster Mill Machinery

Hair and Fiber Pickers
Elevating and Conveying Machinery
Hammer and Revolving Screens
Power Transmission Machinery
Jaw Crushers
Fine Grinding Mills
Calcining Kettles
Mixers

The J. B. Ehrsam & Sons Mfg. Company

Enterprise, Kansas

GAYCO EMERICK

60 mesh to 350 mesh

CENTRIFUGAL SEPARATOR

A Dependable "AIR-SCREEN" for sizing

Fibrous, Flaky or Granular Materials

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RUBERT M. GAY COMPANY **114 Liberty St., New York, N. Y.**

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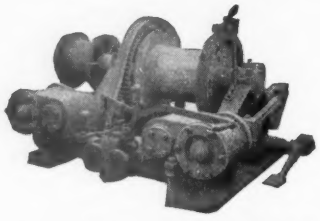

Emerson-Brantingham Hoists

UNUSED

DOUBLE CYLINDER, SINGLE DRUM, IN FIRST CLASS CONDITION

$125.00 Each F. O. B. Chicago

Capacity, 10,000 Pounds
IMMEDIATE SHIPMENT

Detailed Specifications Furnished on Application
"QUANTITY IS LIMITED"

Relaying rails and angle bars, all weights and tonnages, for prompt shipment. Get our quotations

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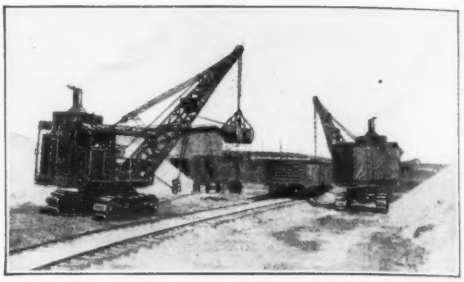
531 Peoples Gas Bldg., Chicago, Ill.



Used for Everything from Handling Aggregate to Setting Heavy Concrete Pipe Sections

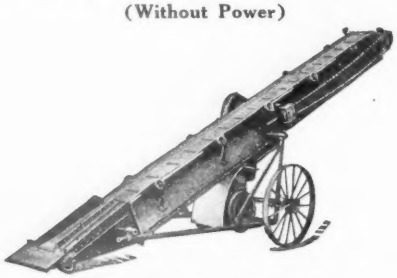
At Verdigris, Oklahoma, the Lock Joint Pipe Co., is using two "AMERICAN" Ten Ton Cranes on Continuous Chain Treads. These are used mainly for handling concrete aggregate, but also to handle heavy 12-foot sections of concrete pipe, dig trench, etc.

These cranes require no tracks and can go anywhere. Their independence of track makes them particularly valuable. Strong, speedy, accurately controlled, these cranes are money makers for anyone who has any great quantity of material to handle with grab buckets. No extra yard tracks necessary; no portable sections. Ideal for road paving work at central mixing plants.

AMERICAN
HOIST & DERRICK CO.
Saint Paul, Minn.
New York - Chicago - Pittsburgh - Seattle - New Orleans - Detroit

ROBINS 20-ft. Portable CONVEYOR $433.00

(Without Power)



F. O. B. Passaic, N. J.

This conveyor, with its troughed belt and absence of skirtboards makes it possible to handle sand, gravel, crushed stone, and other abrasive materials without damage to the edges of the belt.

Note these features:

16-in. Troughed Belt—large carrying capacity.
Self-cleaning Arched Frame—fully protecting the return belt from dirt accumulation.
Rugged Construction—well balanced. Capacity of one ton per minute.

If furnished with 2 H. P., A. C. Motor—$94 additional. With 5 H. P. "New-Way" Gasoline Engine—$175 additional.

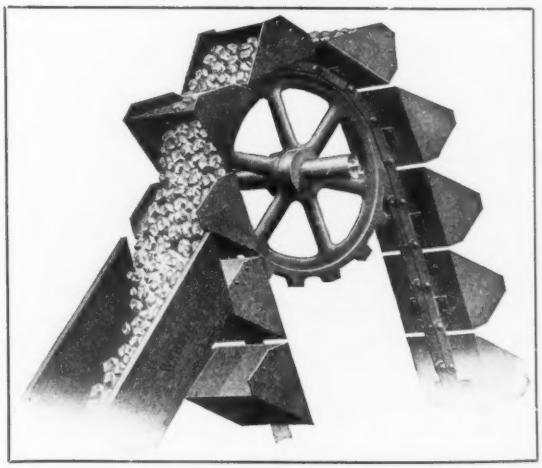
Also built in 25, 30 and 35 ft. lengths.

Send for bulletin giving full specifications

ROBINS CONVEYING BELT CO.
PARK ROW BLDG., NEW YORK
Chicago Boston Pittsburgh

WEBSTER

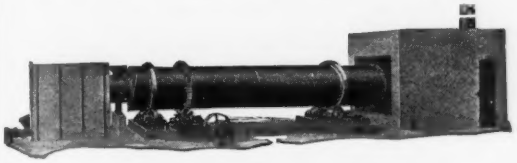
Continuous Bucket Elevators for Vertical or Inclined Lifts



Unusual resources, seasoned experiences and a notable record in exhaustive research gave Webster a leadership in the manufacture of material handling equipment that becomes more marked year by year. The elevators illustrated are low in first cost, have long life, are slow in speed and easily repaired. Made for moderate or large capacities.

THE WEBSTER MFG. COMPANY
4500-4560 Cortland St., Chicago
Factories: Tiffin, Ohio, and Chicago
Sales Offices in Principal Cities

BUCKEYE



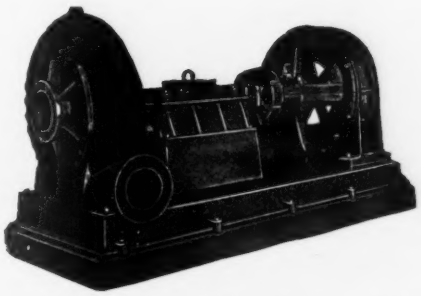
DRYERS

Buckeye Dryers are not made to a standard design—simply a set of steel plates riveted together. Every dryer is designed and constructed to meet the conditions they must work under.

It is only by this method that efficiency can be assured, and we believe we are justified in our claim that the Buckeye is the "most efficient Dryer on the market."

Send for catalog

THE BUCKEYE DRYER COMPANY
131 West Lake Street, Chicago, Ill.



Heavy Service Dredging Pump

Where conditions are too severe for our standard sand pump, the above type is recommended.

It is built in sizes from 4 in. up, arranged for belt, motor, or engine drive.

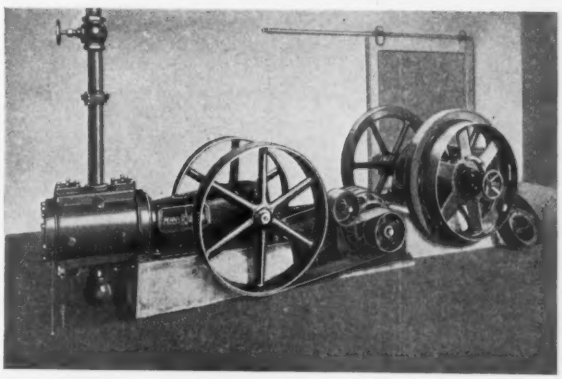
MORRIS MACHINE WORKS
50 Genesee St. Baldwinsville, N. Y.

39 Cortlandt St., New York City
Forrest Bldg., Philadelphia, Pa.
217 N. Jefferson St., Chicago, Ill.
Penobscot Bldg., Detroit, Mich.

Bulletin No. 19-B fully describes our complete line of sand and dredging pumps. Have you your copy?

MORRIS

Since the Civil War Builders of Centrifugal Pumps, Hydraulic Dredges, and Steam Engines



PENNSYLVANIA
AIR COMPRESSORS and PUMPS

To assure Pennsylvania users the greatest degree of satisfaction—our foremost aim—necessitated the designing of numerous exclusive features which have proved pre-eminently successful—affording operating dependability, durability and economical operation. We illustrate above a compressor driven by motor, with oil engine for stand-by service.

Our Nearest Branch Will Forward Descriptive Literature on Request

PENNSYLVANIA
PUMP AND COMPRESSOR COMPANY

MAIN OFFICES AND WORKS EASTON, PA.

BRANCH OFFICES:
325 Penfield Building, Philadelphia, Pa.
30 Church Street, New York City
105 West Monroe Street, Chicago, Ill.

Fig. 283. Sand and Gravel Dredge

HYDRAULIC DREDGES
SAND and GRAVEL DREDGES
DREDGING PUMPS and MACHINERY

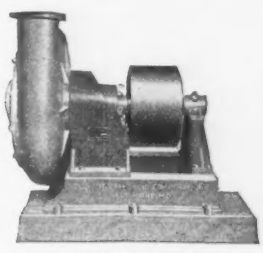


Fig. 280. Dredging Pump

Send for Bulletin 2094

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Ellicott Machine Corporation, Baltimore, Maryland, U. S. A.

THE IRONTON
STORAGE BATTERY LOCOMOTIVE

Before you can buy an Ironton Storage Battery Locomotive our engineering department must know that it will give you satisfactory and economical service. There is no obligation on your part if you allow us to submit definite facts based on a careful survey of your conditions. When we suggest an Ironton, we know that Ironton will make a delighted owner. Write us.

THE IRONTON ENGINE COMPANY
Ironton, Ohio

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1618 Arcade Bldg., St. Louis, Mo.
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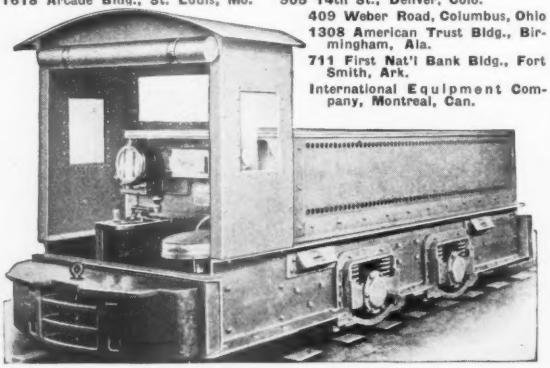
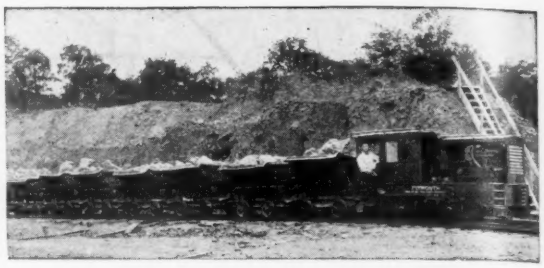
905 14th St., Denver, Colo.
409 Weber Road, Columbus, Ohio
1308 American Trust Bldg., Birmingham, Ala.
711 First Nat'l Bank Bldg., Fort Smith, Ark.
International Equipment Company, Montreal, Can.





21 Plymouth Locomotives Owned by Morris County Crushed Stone Co.

The Morris County Crushed Stone Co. of Morristown, N. J., and its subsidiaries are one of the biggest producers of crushed stone in the country.

In 1915 Mr. F. W. Schmidt, President, bought their first Plymouth Locomotive. Repeat orders followed until now 21 Plymouths take care of their haulage burden. They write:

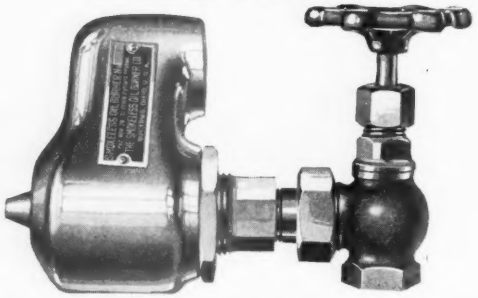
"We still have in operation the first Locomotive we purchased from you in 1915. This Locomotive is still doing its bit, which speaks pretty well of your machine."

Write for Catalog and Performance Bulletins.

THE FATE-ROOT-HEATH CO., Plymouth, Ohio

PLYMOUTH
Gasoline Locomotives

The SMOKELESS Oil Burner



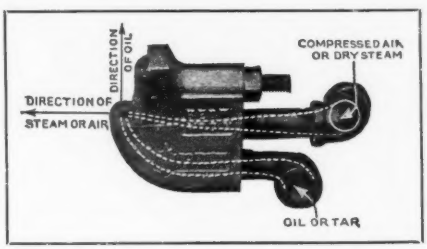
When oil, as fuel, is broken up into a perfect mist, complete combustion is the natural result. Complete combustion means efficiency and economy because none of the fuel escapes as soot or smoke.

The Smokeless Oil Burner atomizes every drop of fuel and it is this feature that makes the "Smokeless" the ideal burner for boilers, dryers and all steam equipment where oil can be used as fuel.

Our Engineers Can Make Worth While Recommendations

The Smokeless Oil Burner Co.
Bucyrus, Ohio
St. Louis Office, 2140 Railway Exchange Building

CALOREX
LIQUID FUEL EQUIPMENT
"Trade-Mark Registered U. S. Pat. Off."



This is beyond all question the most efficient and economical oil burner on the market.

It can be used in lime or cement kilns with less trouble, less cost and the results obtained are more certain than with your present system.

Will increase your locomotive tonnage 15%.
Delays are expensive—Write today.

W. N. BEST CORP.
11 Broadway **New York City, N. Y.**

OSGOOD Again Steps Forward

to meet the demand for a Revolving Steam Shovel of greater capacity. The new OSGOOD 1¼ yd. Heavy Duty now on the market meets this demand. Designed for Heavy Duty work, yet so constructed that speed, simplicity and ease of operation are in no way impaired. This machine must be seen to be fully appreciated.

Ask for Bulletin 236

¾, 1, 1¼ yd. Revolving Steam Shovels, Clamshells and Draglines
1½ to 6 yd. Railroad Type Steam Shovels

The OSGOOD Company
Marion, Ohio

"We now own 3 ERIES—in fact, we have specialized on the reliable ERIE. We find that the mere fact of owning ERIE Shovels brings business, as people know we can do what we say."—*F. P. Behm, Rundle & Behm, Reading, Pa.*

RELIABLE in hard ROCK WORK

WHEN you are selecting a steam shovel, you can make absolutely sure that you buy a reliable machine. Inquire of men who have used different steam shovels in ***severe rock work.*** Find out which shovel has given steadiest service in granite, trap, limestone and flint.

You will surely select the one make of shovel that is noted among quarrymen for "Steadiest service; Fewest repairs."

We will be glad to send you our Bulletin, "Loading Rock with the ERIE Shovel"—photos and cost data. It shows just what the ERIE can do in rock work. Write for Bulletin P-36.

ERIE STEAM SHOVEL CO., Erie, Pa., U. S. A.
Builders of ERIE Steam Shovels and Locomotive Cranes

ERIE Revolving Shovels Steam

Flirting With the Shovels

In the game of crushed stone quarrying a drill that is within flirting distance with steam shovel or the loading gangs is in a dangerous position. A breakdown on the drill, and the whole production schedule is upset.

No. 14 Cyclone Drills, on the job, always keep plenty of stone ahead, and if they should ever be crowded there is no need for worry—the working parts are cast steel, reducing to the very minimum all possibility of breakdowns.

Write for "Big Blast Hole Drills," a semi-technical treatise on quarry drilling and also containing a complete description of Cyclone No. 14 Big Blast Hole Drills.

The Sanderson-Cyclone Drill Co.
Orrville, Ohio
Eastern and Export Office: 30 Church Street, New York City

For 15 Years Our

Industrial Crane

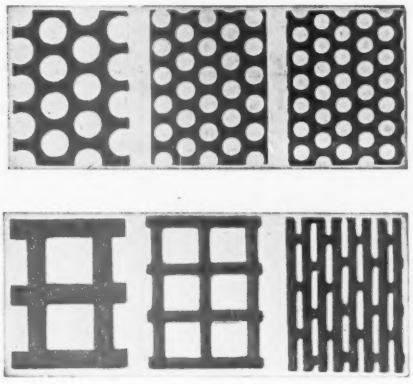
"Has been giving excellent service in stripping dirt off limestone and general work. Further, in being able to drop the bucket down into 12 or 15-foot cavities makes a saving of considerable money over hand labor."

So states Mr. H. W. Smith, General Plant Supt., Charles Warner Co., Devault, Pa., regarding their INDUSTRIAL purchased over 15 years ago and still giving excellent service.

Could you use an INDUSTRIAL in your operations? Let us mail you our Golden Anniversary catalog.

Industrial Works, Bay City, Michigan
New York Chicago Philadelphia Detroit
SALES ENGINEERS IN ALL PRINCIPAL CITIES
1873 BUILDERS OF CRANES FOR 50 YEARS 1923

Perforated Steel Screens



For Screening Stone, Gravel, Sand and Cement

All sizes and shapes of holes in metal of proper thicknesses to give the best screening results.

Sheets furnished flat or rolled to shape for revolving screens.

THE HARRINGTON & KING PERFORATING CO.

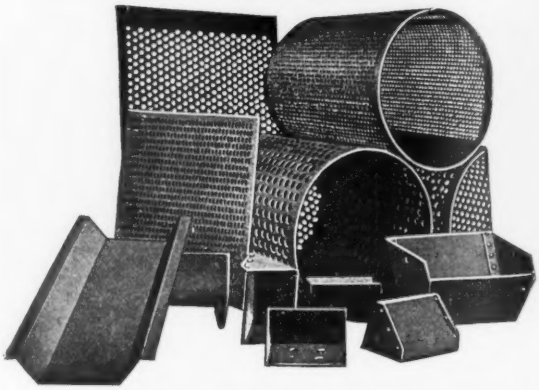
5650 Fillmore St., Chicago, Ill.

NEW YORK OFFICE: 114 Liberty St.

Perforated Metal Screens

FOR

Stone, Gravel, Sand, Etc.



ELEVATOR BUCKETS

PLAIN AND PERFORATED

General Sheet and Light Structural Work

"Light and Heavy Steel Plate Construction"

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Pittsburgh Office, 544 Union Trust Bldg.
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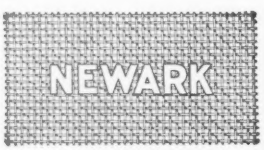

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"NEWARK" Wire Cloth

This cloth is uniform in mesh, therefore producing a uniform product.

The quality of the wire is always the best, assuring the greatest economy.

Screens are made in all metals and in all meshes from 2-in. space to .0017-in. space.

Testing Sieves
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NEWARK WIRE CLOTH CO.

Newark, New Jersey

Uninterrupted Chain Service!

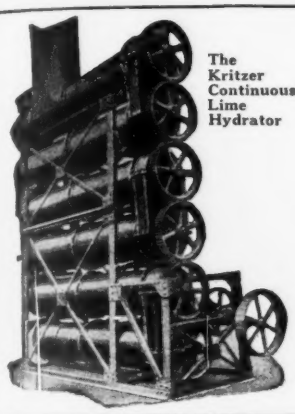
There, Is Your Economy and Increased Production

"Carroll" Solid Weld Chains wear out, but they do not break or pull out at the welds

THE CARROLL CHAIN COMPANY

COLUMBUS OHIO

CRESCENT BELT FASTENERS
They Insure Full Power Transmission
They Sustain the Belt's Full Strength
They Make Good Belts give Better Service
CRESCENT BELT FASTENER CO.
381 FOURTH AVE., NEW YORK.



The Kritzer Continuous Lime Hydrator

HYDRATE

Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost

THE KRITZER COMPANY

503 South Jefferson Street CHICAGO, ILL.

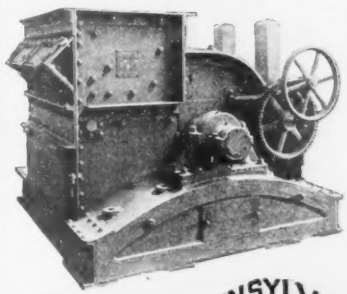
New Holland Rock Crusher

New Holland Rock Crushers will crush oversize from gravel banks or from larger crushing plants into finer grades, thus securing highest prices. They are durable and inexpensive and run on small power with little attention. Built in sizes from 2 to 15 tons per hour, requiring 5 to 15 h.p. to operate.

Write for descriptive catalog and prices on New Holland Rock Crushers, Recrushing Rolls, Rock Pulverizers, Elevators, Conveyors of various types and Revolving Screens.

Manufactured by

New Holland Machine Co., New Holland, Pa., U. S. A.



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for Limestone, Cement Rock, Shale, Lime, etc.

(a) Steel Frame Construction.
(b) Over-size Bearings.
(c) Tramp Iron Separator.
(d) Quick-acting Cage Adjustment.
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Also Single Roll Crushers and Bradford Coal Breakers.

Put your Reduction Problems up to us.

Illinois Merchants Bank Bldg. Chicago

PENNSYLVANIA CRUSHER COMPANY

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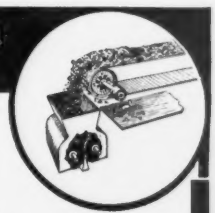
Keeping Tramp Iron Out of Crushers



Hundreds of High Duty Magnetic Pulleys are preventing crusher smash-ups in quarries, saving repair bills and—most important—preventing costly plant shut-downs.

High Duty magnetism will extract every scrap of metal from the material you crush, insuring continuous operation. A High Duty pays for itself within three months! Ask for proof.

Magnetic Manufacturing Co.
291 23rd Avenue Milwaukee, Wis.

FREE

Illustrated booklet on magnetic separation in quarrying industry sent free. Request it on your letterhead.

HIGH DUTY Magnetic Separators

BACON~FARREL ORE & ROCK CRUSHING~WORLD KNOWN ROLLS~CRUSHERS

EARLE C. BACON, INC. ENGINEERS
26 CORTLANDT ST., NEW YORK

Type 31, 6-ft HUM-MER

HUM-MER *Electric* SCREEN

Makes screening and crushing more profitable. Screens any material, wet or dry, from 2½" opening to minus 200 mesh.

Send for Catalogue 45-R

THE W. S. TYLER COMPANY
CLEVELAND, OHIO
Manufacturers of Woven Wire Screens and Screening Equipment

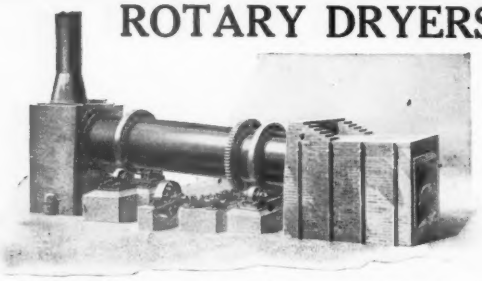
KNOX

Valves-Couplings-Nipples-Clamps-Menders

FOR HIGH PRESSURE AIR AND STEAM SERVICE

The Knox Mfg. Co., 821 Cherry St., Philadelphia

ROTARY DRYERS



Our Rotary Dryers covering a wide range in size and capacity, will successfully solve your drying problems.
The quality is standard, and as an investment they cannot be beaten.

The Hadfield-Penfield Steel Co., Bucyrus, Ohio

AJAX
BULL BEARING ALLOY

"Better than Babbitt"

Ajax Bull Bearing Alloy in your crusher bearings prevents frequent re-babbitting and is a safeguard against costly breakdowns. We'll prove it.

Send for circular A and our offer.

The Ajax Metal Company, Philadelphia
Established 1880
New York Chicago Boston Cleveland

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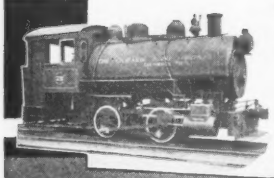

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THE STANDARD OF EXCELLENCE

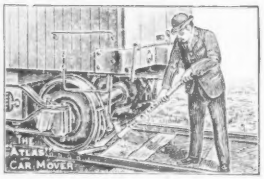
BALDWIN
Industrial and Contractors' LOCOMOTIVES

are in use where dependable motive power is required.

Full information upon request

The Baldwin Locomotive Works
PHILADELPHIA

ATLAS CAR MOVER



The Atlas Car Mover will move a car farther at a stroke and with less effort than any other car mover on the market.

They save time and money. You cannot afford to be without a few.

State what style rail to be used on. We will then know what style to send you.

Write for Prices Today

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431 South Dearborn Street Chicago, Ill.

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LOCOMOTIVE CRANES
OHIO LOCOMOTIVE CRANE CO. BUCYRUS, OHIO

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REPEAT orders indicate satisfied customers. That's why we are proud of the fact that a large percentage of our sales are to people who are already operating Sauerman Cableways. One large sand and gravel company has seven of our machines installed at their different plants. If you wish to know why our equipment is so popular, send for Pamphlet No. 17.

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SAUERMAN DRAGLINE CABLEWAY EXCAVATORS
dig, convey, elevate and dump in one operation

BYERS
Auto-Crane

Its ability to do effective work in limited quarters is just one of its recommendations. Furnished with mounting and power to suit purchaser. Takes all standard attachments.

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310 Sycamore St., Ravenna, O.
Also builders of Full-Circle Cranes, Trucktranes, Buckets, Hoists, etc.

F. L. SMIDTH & CO.

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CEMENT MANUFACTURING PLANTS
CEMENT MAKING MACHINERY
PULVERIZED COAL INSTALLATIONS
GRANULATING AND PULVERIZING MACHINES FOR ALL MATERIALS
FLINT PEBBLES—SILEX LINING
THE LENIX BELT DRIVE

Scientifically Designed Equipment

Zepp Automatic Hydrator
Meade Improved Lime Kilns
Complete Lime, Cement and Plaster Plants

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INSPECTION AND TESTS OF SAND, GRAVEL, CEMENT, STRUCTURAL STEEL, CASTINGS AND CONSTRUCTION MATERIALS

Cement, Chemical and Physical Testing Laboratories

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Insure Fullest Satisfaction

Crushing Rolls.
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Direct and Indirect Fired Dryers.
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Fuller-Kinyon System for Conveying Pulverized Materials.
Sprockets, Traction Wheels, and Roll Heads.
All kinds of High Grade Chilled Charcoal Iron Castings for All Uses.

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Fullerton, Pa., U. S. A.

NOW THEN!

What about labor costs? Do you know that an

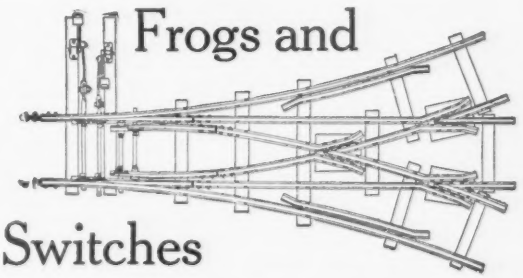
AUTOMATIC AERIAL TRAMWAY

Enables ONE MAN to haul your output to railroad or bin, that the initial cost is low and such lines require little upkeep.

Let Us Submit Figures for Your Consideration

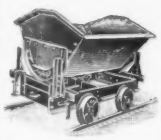
INTERSTATE EQUIPMENT CORPORATION
25 Church Street New York City

Frogs and Switches



The Central Frog & Switch Co., Cincinnati, O.

Frogs, Switches, Crossings, Switch Stands, Rails, Angle Bars, Fish Plates, Throws, Rail Braces, Tie Plates, Portable Track, Etc., Etc.



Industrial Cars and Dumping Buckets of All Kinds

Specialize in

Hoppers, Bins, Bin Gates, Chutes

Penn Foundry & Manufacturing Company
Hillcrest, Reading, Pa.

Electric Motors and Generators

for all requirements of the Rock Products Industry

BURKE ELECTRIC CO.
Main Office and Works
Erie, Penna.

Service Sales Offices
Buffalo Cleveland Detroit
New York Philadelphia Pittsburgh

Sales Agencies
Underwood Electric Co., Cincinnati
W. T. Osborn, Kansas City

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Type ads only. No cuts or illustrations permitted unless at the regular display advertising rates. Please send check with order. These ads must be paid for in advance of insertion

We Have for Sale

Rotary Kilns, Rotary Dryers, Williams Mills, Tube Mills and Gyratory Crushers

EQUIPMENT SALES COMPANY

Nashville, Tenn.

"Wire us your requirements at our expense"
"If we don't have it we will get it"

FOR SALE

One 22x50 in. opening, Good Roads Machinery Co., Jaw Crusher complete, capacity 750 tons per 10 hours when set at 3 in. and 1000 tons per 10 hours when set at 4½ in. The Crusher is new, never installed, and ready for immediate shipment. Will have manufacturer's guarantee with it. Price, $7500, loaded on cars.

One Model No. 30 Marion Full Revolving Steam Shovel on wheels. Mechanism in good shape, boiler retubed, and everything in good working order. Capacity loading stone, 400 tons per 10 hours; loading sand and gravel, 600 tons per 10 hours. One ⅝-in. dipper and one 1-yd. special rock dipper included. Prices, loaded on cars, $3250.

LEHIGH STONE COMPANY, Box 597, Allentown, Pa.

1—59-ton standard gauge American 6-wheel Switcher
1—50-ton standard gauge Shay geared locomotive
1—28-ton standard gauge Shay geared locomotive
1—10x16 in., 36 in. gauge, 4-wheel saddle tank
1—30-ton McMyler bucket-handling locomotive crane
1—14-B Bucyrus Steam Shovel, mounted on traction wheels
10—miles 30 and 35 pound relay steel rails, Canton, Mississippi.

Birmingham Rail & Locomotive Co.

Birmingham, Ala.

FOR SALE

No. 20 Traylor Bulldog Gyratory Crusher
7½D—Gates Gyratory Crusher
No. 10 McCully Gyratory Crusher

ARTHUR S. PARTRIDGE

415 Pine St. Louis

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25′, 3½x25′, 4x30′, 5½x50′, 6x60′ and 7x60′; double shell dryers, 4x20′, 5x30′ and 6x35′; steam-heated air rotary dryers, 4x30′ and 6x30′.

KILNS—Rotary kilns, 4x40′, 5x50′ and 6x70′, 6x100′, 7x80′ and 8x110′.

MILLS—6x8′, 6x5′, 5x4′, 3x3½′ pebble and ball mills; 3′ March mill; 42″, 33″ and 24″ Fuller-Lehigh mills; 4½x20′, 5x11′, 5x20′, 5½x22′ and 6x20′ tube mills; 7½x13″, 9x15″, 16x10″ and 12x26″ jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 24″, 36″ and 40″ cage mills; 3′ and 4½′, 6′ and 8′ Hardinge mills; 18x12″, 20x12″ and 30x10″ roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 5 roll and 2 roll No. 1 and No. 000, No. 00 and No. 0 Raymond mills; one No. 3 and No. 4 and No. 7½ Pelsmith breaker; one 36″ Sturtevant emery mill; one 3 roll Griffin mill; 60″ chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; 6x8′, 6x5′ and 4x3′ Newaygo vibrating screens; Richardson automatic scales; 8′ and 10′ Emerick air separators.

Air compressors.

W. P. Heineken, Engineer

95 Liberty Street, New York. Tel. Cortland 1841

Mine Cars, Rails and Locomotives

We have a number of good, serviceable, standard gauge, second hand locomotives, and narrow gauged ones, for immediate shipment.

M. K. FRANK

Frick Building Pittsburgh, Pa.

FOR SALE

Sand Lime Brick Machinery

One Four Mold Boyd Press
One Abbe Engineering Co. TUBE MILL—spiral feed, 17x5 ft.
One Sturtevant ROTARY LIME CRUSHER, No. 1
Eighty Steel Cars—capacity 850 Brick each, 28-in. gauge
One Air Blower, 24-in. diam. "American"
For full description and prices, address

Winchester Granite Brick Co.

Dudley, Ky.

ROTARY DRYERS

30 New Direct-Fired Rotary Dryers, 4′-0″ diam., 30′-0″ long. These Dryers were about to be put into operation as the armistice was signed, and consequently were never used. We are offering them at a sacrifice, complete with driving mechanism, furnace irons, grates, etc. Some are equipped with steam radiators, for steam heated air drying.

McDERMOTT BROS. CO.

Allentown, Penna.

FOR SALE

1—70 ton Steam Shovel
15—5 ton steel body, end dump, heavy duty standard gauge Quarry Cars.
1—Switching Locomotive, standard gauge.
1—No. 6K Gates Crusher
1—No. 4B Gates Crusher

All in good working order. Low prices to move quickly

INLAND CRUSHED STONE CO.

105 North Clark Street Chicago, Ill.

FOR SALE

Locomotive Cranes

1—10 Ton, 4 Wheel BROWNING
1—20 Ton, 8 Wheel BROWNING
Standard Gauge—Prompt Delivery

F. William Stocker Hoboken, N. J.

For Sale—Steam Shovels

1—70 C. Bucyrus, 2½ yd. Bucket.
1—60 Marion, 2½ yd. Bucket.
Both standard gauge. Immediate shipment.

Consolidated Products Co., Inc.

15 Park Row New York, N. Y.

Used Equipment

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FOR SALE

8—6x115-ft. Vulcan Rotary Kilns; condition A-1; unused.
3—4x23-ft. Hersey Dryers.

Address
Box 1700, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

FOR SALE

Plymouth Gasoline Locomotive, 24" gauge, Model AL No. 326, in very good condition. Inquire of

THE SMALLWOOD-LOW STONE CO.
Lisbon, Ohio

SPECIAL BARGAINS

Send Us Your Boiler Inquiries

66x86 in. TRAYLOR JAW CRUSHING PLANT.
25-50-80-110 HP. Elec. Hoists.
Nos. 4-5-6-7½-9 and 10 CRUSHERS.
6 and 10 ton Gasoline Locomotives.
2 DISC CRUSHERS, 24 and 36 in.
100 TON 2½ yd. ELECTRIC SHOVEL.
50-5000 ft. Steam Belt and Electric Compressors.
13x30 in.; 10x18 in.; 8x14 in. JAW CRUSHERS.
24x54 McLANAHAN ROLL CRUSHERS.
50 HP. D. D. HOIST, 440 V. 3 Ph. Motor Dragline Set; Also 25 HP. Dragline Equip.
100 HP. 1000 TYPE ROH ER. 125 lb.
3 60-HP. GASOLENE S-D HOISTS, PRAC. NEW.
10 and 12 ton ROAD ROLLERS.
5-7½ and 10 HP. PORTABLE CONVEYORS.
750-1000 GPM. UNDERWRITERS STEAM PUMPS.
Dryers, Pulverizers, Locomotive Cranes, Shovels.

Write. Let us supply your wants

ROSS POWER EQUIP. COMPANY
Indianapolis, Ind.

FOR SALE

4000 lin. ft., 30-in., 20 lb. Track
12 30-in., 1½-yd. Cars
PLYMOUTH GASOLINE LOCOMOTIVE

F. WILLIAM STOCKER
Hoboken, N. J.

For Sale—STEAM SHOVEL

⅝ YD. THEW "O" TRACTION

Thoroughly rebuilt; attractive terms for quick sale.

Walter A. Zelnicker Supply Co., St. Louis
Rails, Locomotives, Cars, Tanks, Pipe

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Position Wanted

Young man, college graduate, with 15 years all around practical manufacturing and executive experience, including cost accounting, is looking for an opening where he can eventually become directly associated with the management of the business. The last two years he was plant manager of a small hydrated lime plant. Full information on request.

Address Box 1676, care of Rock Products
542 South Dearborn Street Chicago, Illinois

COMBUSTION ENGINEER

Specialized on rotary cement kilns. Has spent after graduation 13 years on study and development of industrial furnaces. Likes trouble shooting, investigation and reporting. Has been for years connected with leading concerns in combustion field. Owns patents, has published articles, and has good references. Wishes full or part time employment with big concern or consulting work. Address

Box 1704, care of Rock Products
542 South Dearborn Street Chicago, Illinois

Will sell cheap 33 tons new Danish flint grinding pebbles size B. Great Western Portland Cement Co., 310 Rialto Bldg., Kansas City, Mo.

WANTED

Good machinist familiar with crushing and grinding machine. Apply

Clifford L. Miller
West Stockbridge Massachusetts

An Opportunity

A small lime concern with a growing business is in need of a good operating man and will make it possible for the right man to share in the business on some fair basis as soon as he has proven himself. State your qualifications fully and please do not reply unless you do so with the idea of permanency in mind.

Box 1705, care of Rock Products
542 South Dearborn Street Chicago, Illinois

Owner of well equipped rock crushing plant and riprap quarry in the southwest, unlimited supply of good stone, large crushing capacity, well located, good established business, but owing to other interests can give the plant but little attention except in an advisory capacity, wants energetic, experienced quarry man with little capital to take over the plant on a desirable basis. Only those capable of handling such a proposition need answer. Address

Box 1702, care of Rock Products
542 South Dearborn Street Chicago, Illinois

FOR SALE

Eighty acres of high calcium limestone, located at Tyndall, Manitoba, Canada, 28 miles from Winnipeg, on the Canadian Pacific R. R. Unlimited market, a splendid opportunity for a lime manufacturer. For further particulars address

James Marr, 1316 L Street, Bedford, Ind.

Experienced Manager

Opén pit or underground quarry superintendent or manager open for employment. Fifteen years' experience. Best references. Nominal salary with share in profits produced.

Address Box 1678, care of Rock Products
542 South Dearborn Street Chicago, Illinois

FOR SALE

Complete sand and gravel plant. Present capacity four hundred tons per day. An ideal deposit, excellent in quality, deep, and forty acres in extent. Railroad and trucking deliveries. Address

Box 1683, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

I Want to Buy

A good undeveloped sand and gravel property or an interest in a going business in the Central States. Address

Box 1703, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

FOR SALE

100 ton Crushed Stone Plant — fully equipped, nicely located—good railroad facilities—well established market.

LUFKIN ROCK COMPANY
Lufkin, Texas

FOR SALE

No. 18 Universal Pulverizer—Replaced by larger machine, 90% new with 1¼-in., ¾-in. and ⅜-in. Grate Bars. Price $650 F.O.B. plant. Immediate delivery.

LEESBURG SLICA SAND COMPANY
New Castle, Pa.

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IDEAS—

You could use an idea now and then, couldn't you?
You'll find plenty of new ones, short cuts and time savers in ROCK PRODUCTS.

Our traveling editors are running around, dropping in here and there finding out just how things are done, and then they tell you how the other fellow makes things hum.

Practical stuff—tested ideas—something *you* can use
Better fill out the blank and mail it to us today

ROCK PRODUCTS Date.....1922
542 So. Dearborn St., Chicago, Ill.

Please enter my subscription to ROCK PRODUCTS for.....year.... (one year $2.00, two years $3.00—please state which. You save a dollar by subscribing for two years), for which we enclose $..... Canadian and Foreign Subscriptions $3.00 a year.

Name.....

Street.....

City..... State.....

We produce:.....

.....

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We retail.....

Confidence Justified

CONFIDENCE, whether it be in an individual or a locomotive crane always gives a feeling of deep satisfaction. The confidence which the Houston Construction Company have in their No. 2 Brownhoist creeper truck crane has been justified by the economical and dependable service which their crane has given them.

The Houston Company say of their crane, "After quite a bit of investigation we purchased a Brownhoist because we consider it the best built machine on the market. We are indeed highly pleased with its operation and don't think anyone can make a mistake in purchasing a machine of this kind."

The good service which this crane is giving on the above company's work is typical of Brownhoists on all kinds of handling work. We would like to go over your handling needs with you and tell you more about the economy of Brownhoist cranes.

The Brown Hoisting Machinery Co., *Cleveland, O.*

Branch Offices: New York, Chicago, Pittsburgh, San Francisco, New Orleans

BROWNHOIST

MATERIAL HANDLING MACHINERY

When writing advertisers please mention ROCK PRODUCTS

The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Entered as second-class matter, July 2, 1907, at the Chicago, Illinois. Postoffice, under the Act of March 3, 1879.

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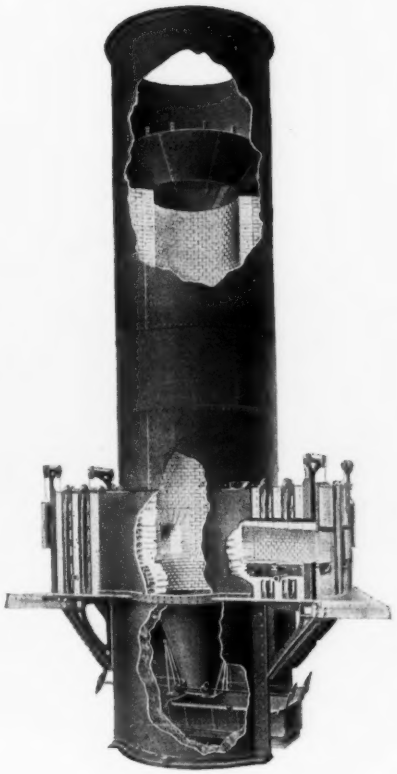
Why Pay Steam Shovel Costs?

Why put up with the expense of a watchman? Why pay the cost of coal? Why haul water and be bothered by the troubles of steam when the sturdy Northwest brings constant service plus the economy of gasoline.

Northwest Engineering Co.
1234 Steger Building
Chicago

NORTHWEST
GAS or CRANES · SHOVELS · DRAGLINES ELECTRIC



KEYSTONE
Lime Kilns

A good vertical lime kiln is one thing, but service rendered by engineers who "know the game" is quite another. Seldom are the two combined.

Keystone Lime Kilns embody a principle which increases the capacity and simplifies the operation.

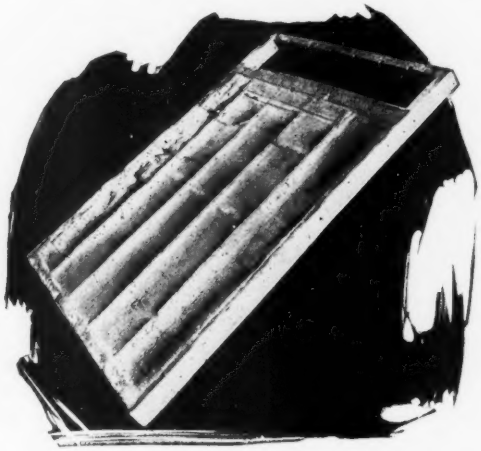
Keystone engineers have gained their experience in erecting and operating kilns. They are in a position to know what the user requires.

Steacy-Schmidt Manufacturing Co.

Engineers and Designers

York, Pa. **1201 Pennsylvania Bldg., Philadelphia**

Screening for Profit!



Worn Out in Two Weeks

This screen never had a chance!

Look at the patches, the holes, and the way this screen cloth sagged after less than two week's service.

This shows what happens to a screen cloth when it is tacked, riveted, or bolted to a frame. To apply screen cloth by these old methods is like leading it to slaughter —its life is cut short and the screen cloth never has a chance to render efficient service.

To keep a screen from wearing through in spots, it must be kept taut. On a drumhead tension screen, the material spreads evenly over the entire surface; the wear is uniformly distributed; and the maximum screen life is obtained.

The HUM-MER Process of screening at drumhead tension makes wire cloth screen faster and wear longer.

Send for Catalog 45-R

Screen Life on Hum-mer

"Life of screens 6 to 10 weeks." *Highland Sand & Gravel Co.*

"Screens last 3 to 5 months." *Castalia Portland Cement Co.*

"Screen life about one year." *Bessemer Limestone & Cement Co.*

"Screens good for at least a year." *Hocking Valley Fire Clay Co.*

"Screens last at least six months." *Cleveland Brick & Clay Co.*

"Screens last about three months." *Myles Salt Company.*

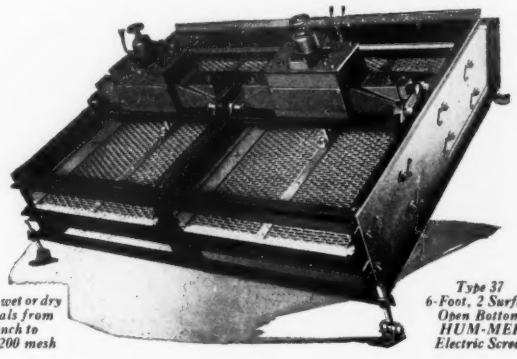
"After three months operation, the screens show very little wear." *National Construction Co.*

"Hum-mer screens are giving entire satisfaction, especially the Ton-Cap wire cloth." *Morris Fertilizer Co.*

"Replace screen twice a year." *Diamond Sand & Gravel Co.*

"Much pleased with long life shown by screen cloth." *Straitsville Impervious Brick Co.*

"Wire surfaces not replaced in 1½ years." *Eastern Talc Company.*



Screens wet or dry materials from 2½-inch to minus 200 mesh

Type 37 6-Foot, 2 Surface, Open Bottom HUM-MER Electric Screen

THE W. S. TYLER COMPANY, *Cleveland, Ohio*

Manufacturers of **Woven Wire Screens and Screening Equipment**

When writing advertisers please mention ROCK PRODUCTS

America solves its immigration problems

America is faced by a shortage of labor

A prominent industrial executive said, in a recent speech—

"America is faced by a shortage of labor, due principally to the laws restricting immigration. These laws as passed are the worst things that ever happened to this country economically. There is a great abundance of labor on the other side of the water that would be glad to come over and develop our resources."

The above statement is by one of the country's leading Industrial Executives

American Industries are face to face with a shortage of labor that calls for extraordinary methods to surmount.

The same speaker also said, referring to immigration, ". . . the number allowed to come here should be equal to the necessities of our industries."

But legislation is against this happening.

Labor-shortage must be made up for in some way.

And fortunately this way exists.

You can't evade giving a final answer to this question. You may postpone it, but sooner or later you must lay the cards on the table, face up, and decide.

And your logical answer must be in line with the statement of Floyd Parsons, one of America's foremost Industrial Writers, who says:

"That labor-shortage must be met with labor-saving devices that will more than make up for the labor shortage."

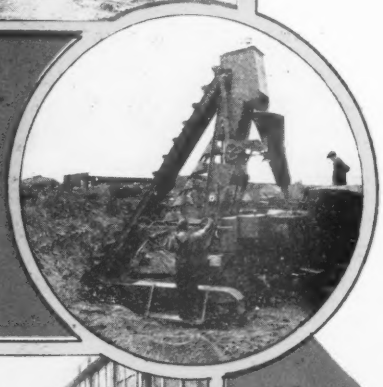
For Forty years, Jeffrey Labor-Saving, Material Handling Equipment has been solving the problem of saving and aiding labor.

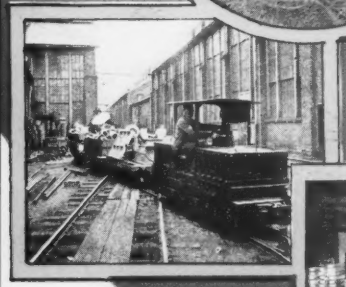
Thus, today, the Jeffrey organization stands shoulder to shoulder with you, backed by all its wealth of experience to help you successfully meet a vital situation with Elevating and Conveying Machinery for practically every purpose.

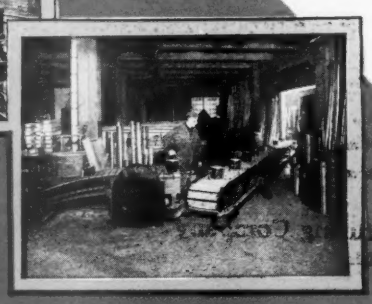
The Jeffrey Manufacturing Company
Columbus, Ohio

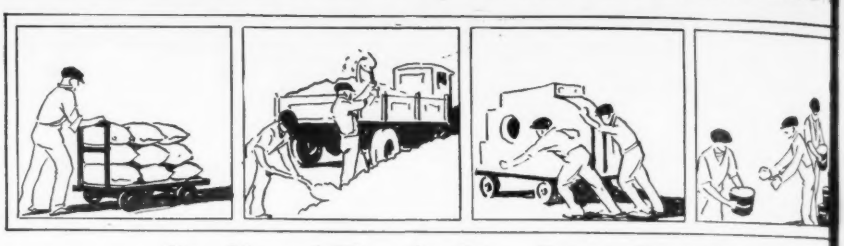
JEFFREY
MATERIAL HANDLING AND MINING EQUIPMENT

...y handling it mechanically—









How Many of These Conditions Exist in Your Plant?

DON'T WASTE LABOR

A comparison here of opposite conditions illustrates th real savings obtained through the use of Jeffrey Labo Saving Equipment.

There are too many human carriers doing the wor that a labor-saving device can do more economically.

A few feet of Jeffrey Elevator or Conveyor used whe ever one or more men are handling materi makes you independent of the labor-shorta and produces greater profits.

The Jeffrey Manufacturing Compa
Columbus, Ohio

JEFFREY

MATERIAL HANDLING AND MINING EQUIPMENT

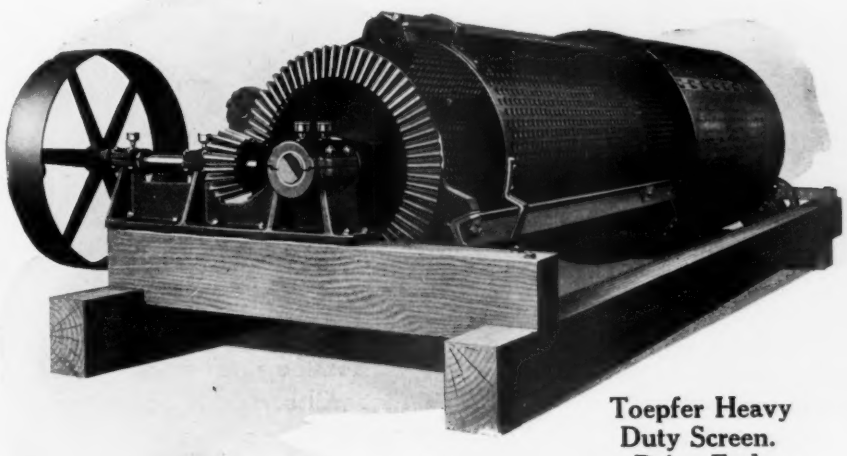
The TOEPFER SCREEN

Behind Toepfer Screens is a complete modern plant backed by an organization with years of experience and noted for its high standard of quality.

It takes real service to show the advantages possessed by Toepfer Screens. They are scientifically engineered to this duty by experts, constructed with scrupulous care of the material that assures durability even under unusually severe conditions.

Manufacturers of machinery and equipment for the pit and quarry and Toepfer Hydrator.

W. TOEPFER & SONS COMPANY
Milwaukee Wisconsin



Toepfer Heavy Duty Screen. Drive End.

Portland Plant of Shope Brick Co. The Corner Structure Houses the Show Room and Offices

The Survival of the Fittest

Six clay brick plants that were supplying the Portland, Oregon, market, quit in the face of Shope competition, and that during the period of the greatest building activity in the history of the city.

Clay brick competition is the easiest thing in the world for a Shope Concrete manufacturer to overcome. Shope Concrete Brick has no peer as a building unit. It is beautiful in design, absolutely waterproof and higher in quality than any other brick on the market.

The Shope exclusive license plan of selling Shope Patented machinery and Patented process, provides that each purchaser, within a prescribed territory shall enjoy as full, exclusive and monopolation right to manufacture and sell Shope Concrete Brick.

The manufacture of Shope Concrete Brick is a profitable business, a permanent industry worthy of investigation by every producer of sand, gravel, crushed stone or slag.

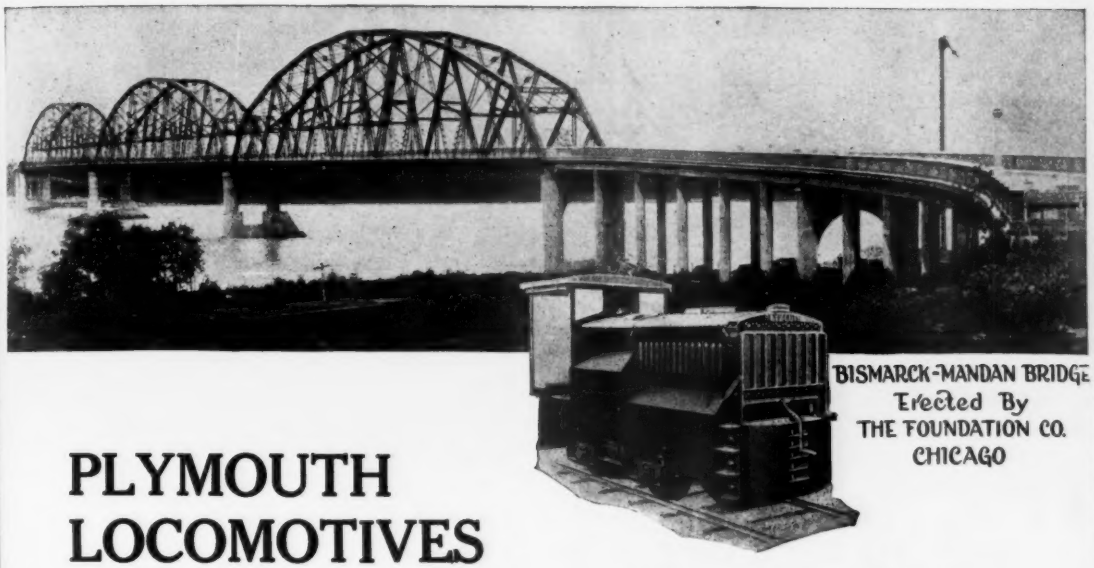
A separate organization will create a market for the product of the parent company that will surpass all expectations and materially reduce overhead during off-months.

SHOPE QUALITY BEAUTY UTILITY Impervious Fire Resisting **BRICK**

Write for Details Concerning Your Territory

Common Brick **SHOPE BRICK COMPANY** *Face Brick*

PORTLAND, OREGON



BISMARCK-MANDAN BRIDGE
Erected By
THE FOUNDATION CO.
CHICAGO

PLYMOUTH LOCOMOTIVES
Help Build Bismarck-Mandan Bridge

The Foundation Company of New York and Chicago, the biggest concern of its kind in the world, built the foundations and did all of the concrete work for this great bridge across the Missouri River, near Bismarck, North Dakota. The river bed is formed of silt, over a deep stratum of stiff clay, and it was necessary to carry the foundations down to a depth of 70 feet to reach this clay and insure permanency.

The bridge proper consists of three main spans, 476 each, center to center, with concrete approach on curve, about 400 feet on the east and 600 feet on the west end. The deck provides a roadway 27½ feet wide and two 6-foot walks.

Two 3-ton Plymouth Locomotives were used for hauling the concrete for the foundations, and at no time did the Plymouths keep the job waiting.

If you have a haulage problem, put it up to us and we will send you figures and interesting literature.

The Fate-Root-Heath Co.
Plymouth, Ohio

PLYMOUTH
Gasoline Locomotives

KOEHRING

Crane Excavator

Quickest Changeability Greatest Flexibility

TWO line speeds from two independently controlled drums. Change from dragline to clamshell work, merely by shifting a clutch! No gearing to replace. As quickly changed into power shovel—easily changed for pile driver and magnet.

A lever for every function

No double function levers. Combine any functions at will as a time-saving practice. The Koehring is designed for it. No penalty of excess wear.

Koehring "heavy duty" construction means the utmost of safety-margin against breakdowns and delays, the utmost of trouble-free service life.

Write for Koehring Crane Catalog No. 29 today.

No. 2 Capacity: 12 tons at 12′ radius. ½ yard clamshell bucket loaded with sand or gravel at 45′ radius. ¾ yard clamshell bucket loaded with sand or gravel at 39′ radius. 1 yard clamshell bucket loaded with sand or gravel at 33′ radius. 1½ yard clamshell bucket loaded with sand or gravel at 24′ radius. 1 yard Page drag bucket on a 40′ boom.

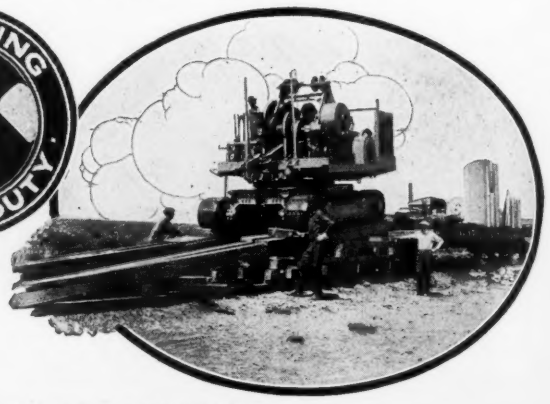
No. 3 Capacity: 20 tons at 12′ radius. 1 yard clamshell bucket loaded with sand or gravel at 50′ radius. 1½ clamshell bucket loaded with sand or gravel at 39′ radius. 2 yard clamshell bucket loaded with sand or gravel at 33′ radius. 1½ yard Page drag bucket at 40′ radius.

No. 1 Capacity: Equipped with 30′ boom. Handles ¾ yard bucket at 25′ radius; lifting capacity at 12′, 14,000 lbs. 4 cylinder 5″ x 6″ gasoline engine.

KOEHRING COMPANY

MANUFACTURERS OF CONCRETE MIXERS AND CRANE EXCAVATORS

MILWAUKEE, WISCONSIN



Shovels handling 75% earth
Average upkeep cost for
Shovels handling 73% rock, etc.
Averaged 55 cu. yds. per hour
for 600 working days.

HOW much should it cost to run a power shovel?

Actual output records and upkeep costs

—now being distributed free to contractors and others who are interested in steam shovel work

The book gives average outputs and upkeep costs of ERIE Shovels on earth work, rock work, clay excavation, sand and gravel production, etc. Cost of actual repairs, also cost of cable, grate bars and dipper teeth.

The records of 48 different machines are given, with yardages, kinds of material handled, number of days worked and upkeep costs ***per working day*** and ***per cubic yard of material.*** Illustrated with 48 photos, showing many different kinds of work. 72 pages.

If you are going to use a steam shovel for any kind of excavation, this book will give you an accurate idea of outputs and upkeep costs.

Tear off the coupon at the right, and mail. We will send this record book without any obligation on your part.

Get your copy of this 72-page book —it's free

Many very favorable comments on this book are being received every day. Here are just a few:

"Expect to give your Upkeep Cost Book close study. It is very interesting"—*Walley & Kelly Constr. Co., Kansas City, Mo.*

"I am very glad to have this book in my files for reference. I find the figures are very good."—*W. P. Cottingham, City Eng'r, Gary, Ind.*

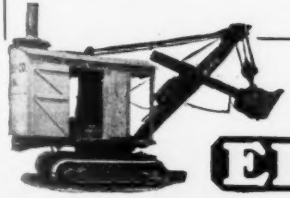
"Your upkeep cost book is very complete and interesting."—*Ferguson Constr. Co., Rockford, Ill.*

"Splendid book—glad I got one." —*W. F. Babel, Cincinnati, Ohio.*

"This is the most attractive, instructive and interesting booklet that the writer has seen for some time."—*The Waterous Eng. Co., Ltd., Brantford, Ontario, Can.*

"Your book up upkeep costs will prove of exceptional value."—*Jas. D. McCarthy, Beardstown, Ill.*

And many more!



ERIE STEAM SHOVEL CO.
Erie, Pa., U. S. A.

Incorporated 1883; formerly BALL ENGINE CO.

Builders of ERIE Steam Shovels, Locomotive Cranes, Railway Ditchers

Branch Offices:

Boston **New York** **Philadelphia**
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Export Representatives:
Gaston & Co., Inc.
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TEAR OFF AND MAIL THIS COUPON

ERIE STEAM SHOVEL CO.,
Erie, Pa.

Gentlemen:

Please send me your 72 page book on Output Records and Upkeep Costs of ERIE Shovels.

Name .....

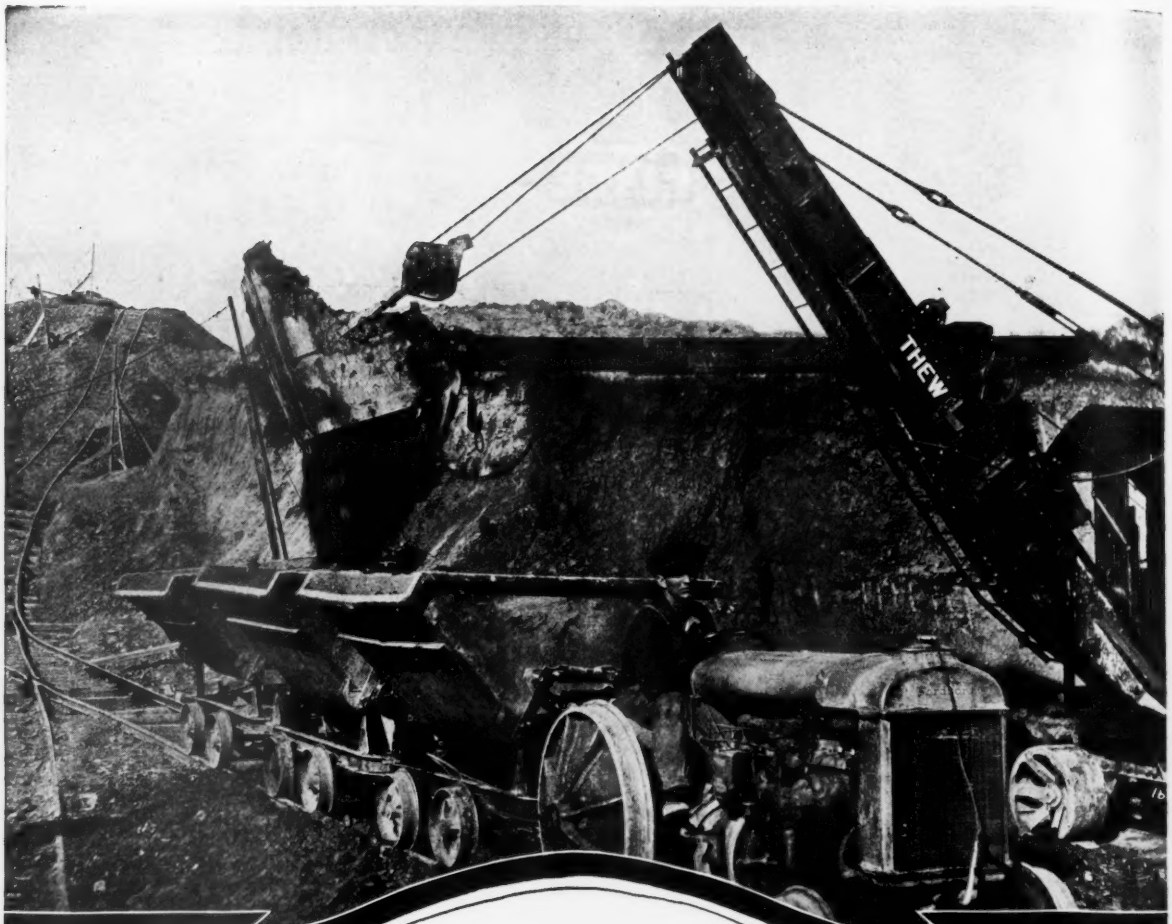
Company Name .....

Street Address .....

City .....

We may be in a market for a shovel or crane about (date) ..... for .....

P ..... (kind of work)



Thew Shovel Company will supply Williamsport Wire Rope on new equipment if so specified

Hundreds of big operators are today insisting upon

Williamsport PATENTED TELFAX TAPE MARKED Wire Rope

and the protection it affords

It is the only wire rope made that cannot be substituted as to grade without immediate detection by the user.

If you want to know how important this is, take pieces of the 5 grades of wire rope, same size, and see if anyone can tell which is which. Warehouse mistakes are happening all the time. If you want to eliminate them and safeguard the lives of your workmen insist upon Williamsport-Telfax Tape Marked.

Write for our booklet MWR, which tells an interesting illustrated story about "Telfax Marker."

Our new catalog is just off the press—send for it.

Williamsport Wire Rope Company

Main Office and Works
Williamsport, Pa.

General Sales Office
Peoples Gas Bldg., Chicago

Clydes on the Job

CLYDE

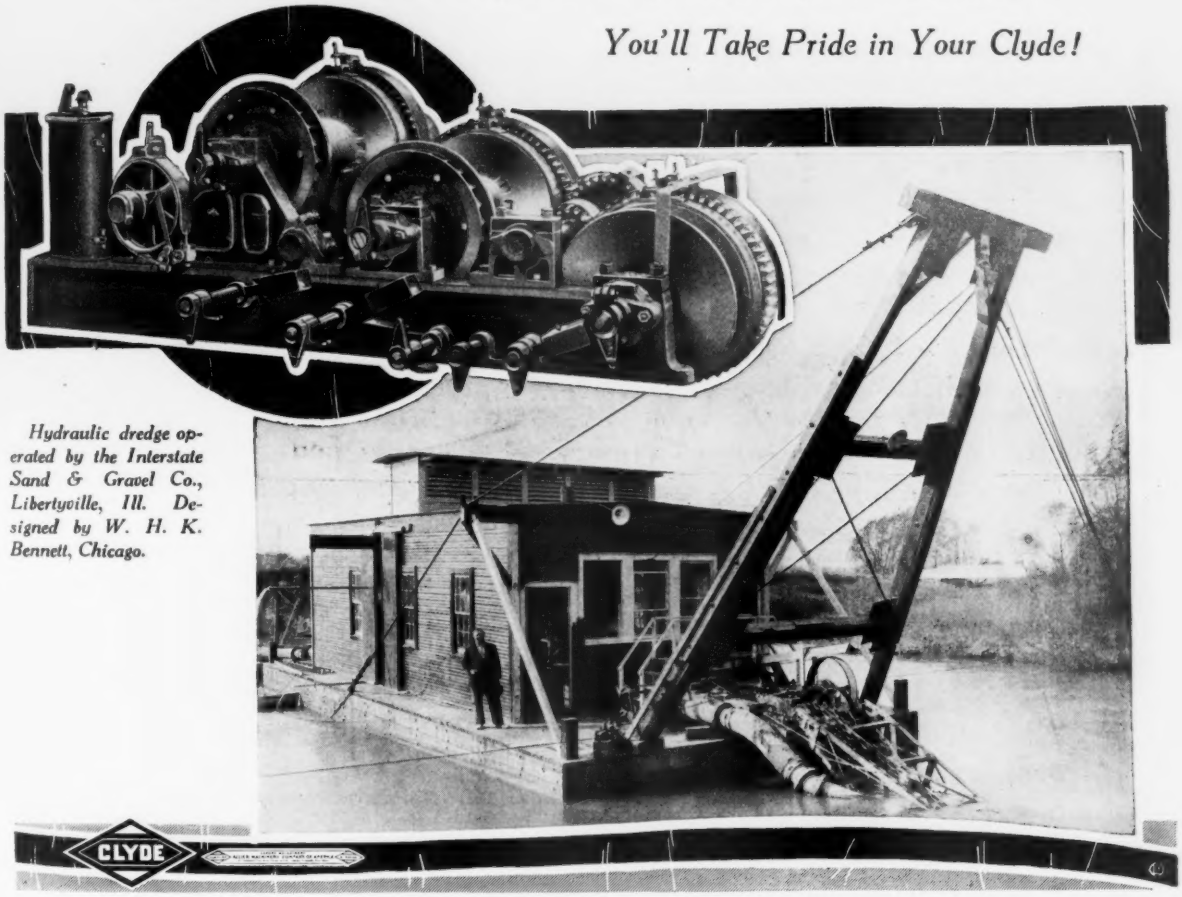
Shown in the photograph below is a hydraulic dredge used for harvesting sand and gravel from a river bottom. The equipment has a capacity of 2,000 tons per ten hours. The dredge hull is 60 ft. long, 26 ft. beam and 4 ft. deep. A 12-inch hydraulic pump raises the sand and gravel.

A 15 H. P. Clyde Electric Hoist with two main drums and two pony drums cares for the raising and lowering of the suction line and cutter, the raising of the spuds and the swinging and moving of the dredge hull. One man handles the whole operation.

This installation is very similar to the Springfield-Pekin Gravel Co.'s operation described elsewhere in this issue, which is also operated with a Clyde Electric Hoist.

Complete information about this or any other portion of the Clyde line furnished upon request.

You'll Take Pride in Your Clyde!



Hydraulic dredge operated by the Interstate Sand & Gravel Co., Libertyville, Ill. Designed by W. H. K. Bennett, Chicago.

CLYDE

CLYDE IRON WORKS SALES COMPANY

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A Working Principle—Not an Embalmed Ideal

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FEW there are who do not know of the great TRUTH and BETTER BUSINESS movement, which was inaugurated by the Associated Advertising Clubs of the World about ten years ago.

It was the fused and awakened sentiment of the publishing and advertising interests, that to them belonged the responsibility for purifying the stream of publicity and keeping it clean.

Since then these men have procured the adoption of clean advertising laws in nearly every state, with Vigilance Committees to enforce them. The crooks and swindlers have been driven from the pages of reputable publications, and the power and virility of straight truth-telling has been brought home to all advertisers.

As the Business Press Department of the National Advertising Commission of the A. A. C. of W., The Associated Business Papers, Inc., is proud and glad to be a part of this work. We have incorporated the TRUTH motive into our own standards and our practices.

Note well the word "ALL" in Standard No. 2. It applies with equal force to ***all*** departments of our papers—editorial as well as advertising.

As a logical sequence of Standard No. 2, we adopted Standard No. 5

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Do you not begin to see why business papers aspire to A B P membership; why membership carries the prestige that it does; and why A B P papers are getting preferred consideration from those who believe in high standards especially when coupled with practical achievement?

THE ASSOCIATED BUSINESS PAPERS, INC.

JESSE H. NEAL, *Executive Secretary*

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Seeing You Through

We do not feel that our responsibility ends when we sell you explosives. **We want to see you through.** We are as anxious as you to get a clean pull.

Grasselli Explosives will do your blasting job—**right.**

Call for one of our practical field men if you have a blasting problem. These men are not high-brow oracles but practical men who have made a special study of explosives and blasting and who are anxious to co-operate with you.

Just Call Our Nearest Office—
No Cost—No Obligation

The Grasselli Powder Co.
Main Office: Cleveland, Ohio

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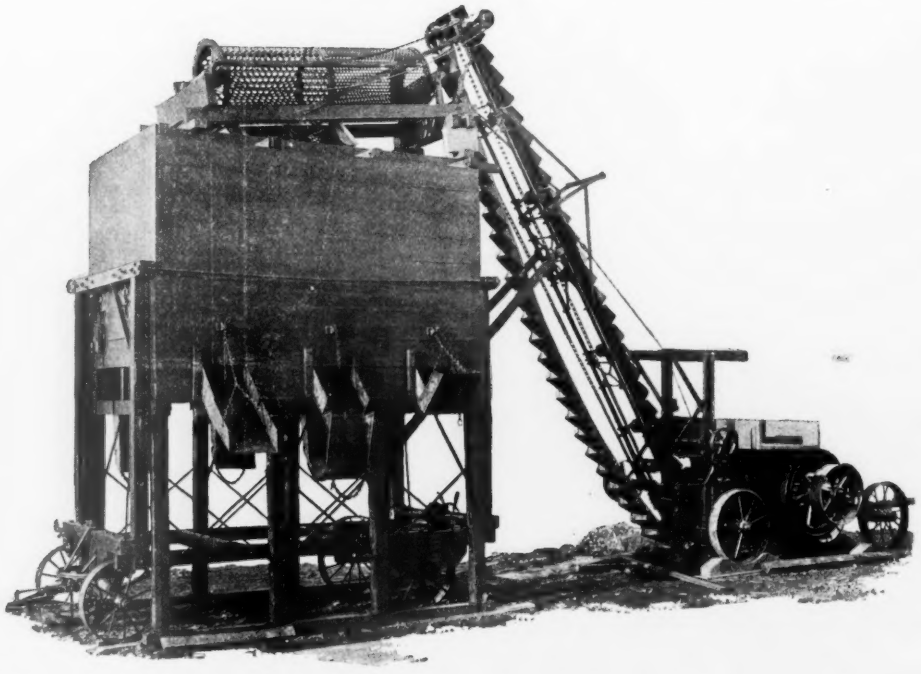
CHEMICALS ZINC GRASSELLI EXPLOSIVES DYESTUFFS

GRASSELLI EXPLOSIVES



Continuous Crushing

Unlike those in all other jaw crushers, which are only actually crushing 50% of the time, the jaws in the Western-Aurora Crusher are never idle. While the top half opens to grasp new stone, the bottom half closes, and vice versa. Yet there is no dead center.

This feature is alone enough to account for increased production, and lessened operating costs and wear and tear; but there are others almost equally important.

Catalog 44-H tells the whole story.
Shall we send you a copy?

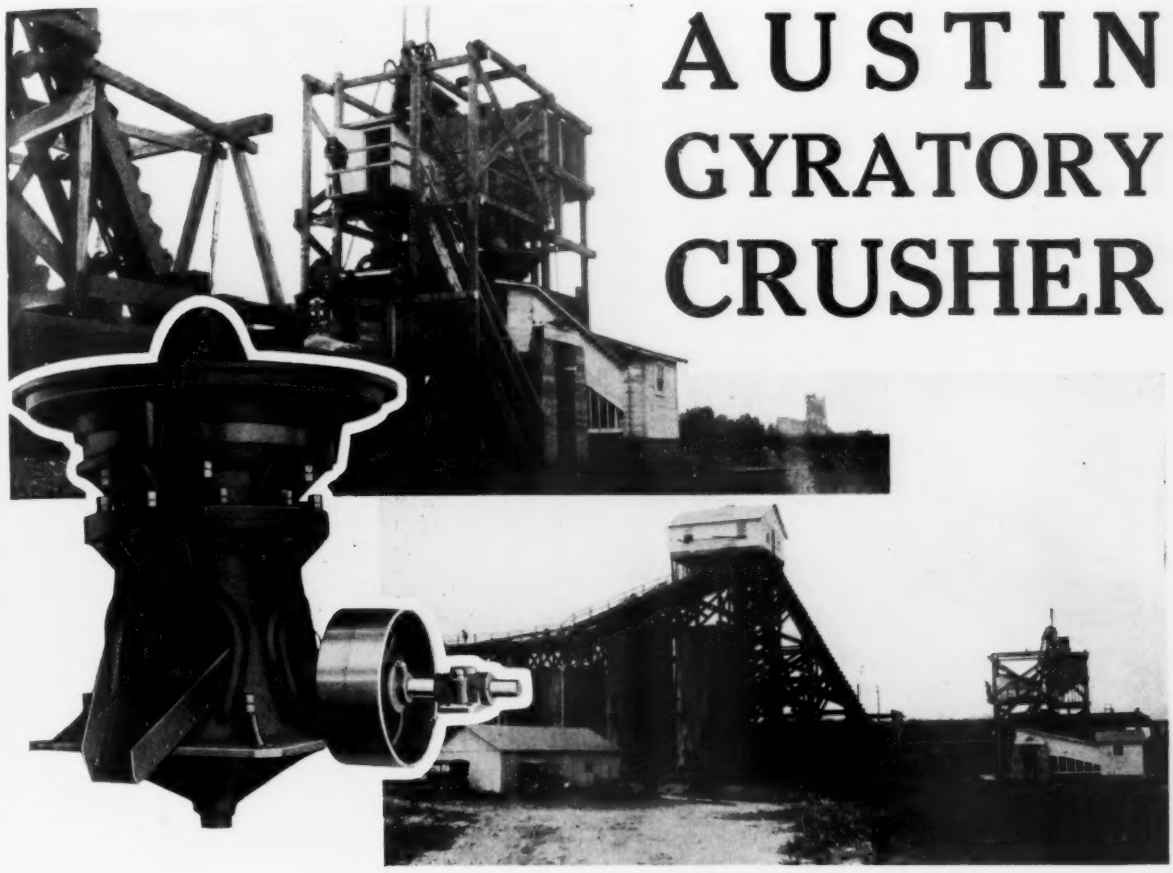
THE AUSTIN-WESTERN LINE · IT SERVES YOU RIGHT ·

The Austin-Western Road Machinery Co.

CHICAGO, ILLINOIS

Branch Warehouses and Service Stations

Albany, Atlanta, Billings, Columbus, Dallas, Denver, Fargo, Jackson, Miss., Kansas City, Mo., Little Rock, Los Angeles, Nashville, New Orleans, New York City, Oklahoma City, Philadelphia, Portland, Ore., Richmond, Salt Lake City, St. Paul, Wahoo, Neb., San Francisco



AUSTIN GYRATORY CRUSHER

At the Springfield-Pekin Gravel Co.'s Plant

The new plant of the Springfield-Pekin Gravel Company just outside of Pekin, Illinois, can justly be called a model in design and construction.

Dredging is the method chosen for excavating the deposit, which consists of 65 per cent gravel and 35 per cent sand and contains a considerable proportion of cobbles which require crushing. For this purpose a No. 5 Austin Gyratory Crusher was chosen, which reduces the stone to 2 inches in size.

The Austin has been given the strength to stand up under severe shocks and strains, together with the ability to turn out the greatest amount of work with the least expenditure of time and power.

Catalog 29-T will tell you the story of Austin leadership

Austin Manufacturing Co.

New York **Chicago** **San Francisco**

When writing advertisers please mention ROCK PRODUCTS

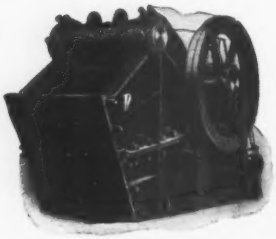
Crushing Plant Equipment

The many crushing plants which have been completely equipped by the Allis-Chalmers Manufacturing Company is evidenced by the satisfactory service which these plants are giving. The Allis-Chalmers Manufacturing Company takes the entire ***responsibility*** for the design of the plant and its equipment. These plants are built on the highest engineering standard following the best engineering practices.

Our Engineers are at your service to make complete installation drawings

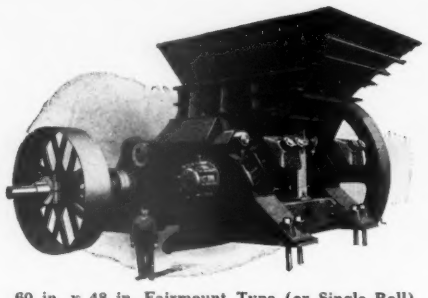
Gates No. 27 Gyratory Crusher, having two openings, each 54 in. x 141 in.

The Gates Style N Crusher, which has been developed in all sizes, is the result of 40 years' accumulated experience of the engineers and designers of the Gates Iron Works and the Allis-Chalmers Mfg. Co.



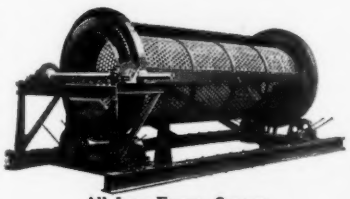
Jaw Crusher

The company has also developed in all sizes Jaw Crushers for crushing copper ore, blast furnace flux and ballast stone.



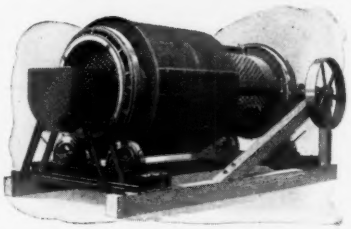
60 in. x 48 in. Fairmount Type (or Single Roll) Crusher

The Fairmount Crusher is intended to crush limestone, dolomite, phosphate rock, magnesite and other less tenacious rocks. It is not suitable for, nor do we recommend it for granites, trap rock or other igneous rock.



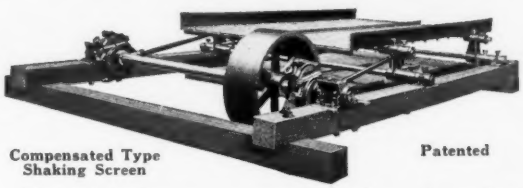
All Iron Frame Screen

The durability, simplicity and efficiency of the Gates Patented All-Iron Frame Screens is unequalled by any other screen on the market.



Style "B" Open End Revolving Screen

Gates Screens are built in numerous sizes, ranging from 24-in. diameter by 8 ft. long, to 72 in. diameter by 24 ft. long. Open End ScalpingScreens of the Cylindrical type are built in sizes ranging from 48 in. to 72 in. diameter.



Compensated Type Shaking Screen

Patented

By balancing one screen against the other, much of the vibration in the frame and building is eliminated. Up-to-date commercial limestone and gravel plants realize the vital importance of installing shaking screens, permitting the production of smaller stones to meet the market requirements.

Write for Our Bulletins

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Electrical Machinery
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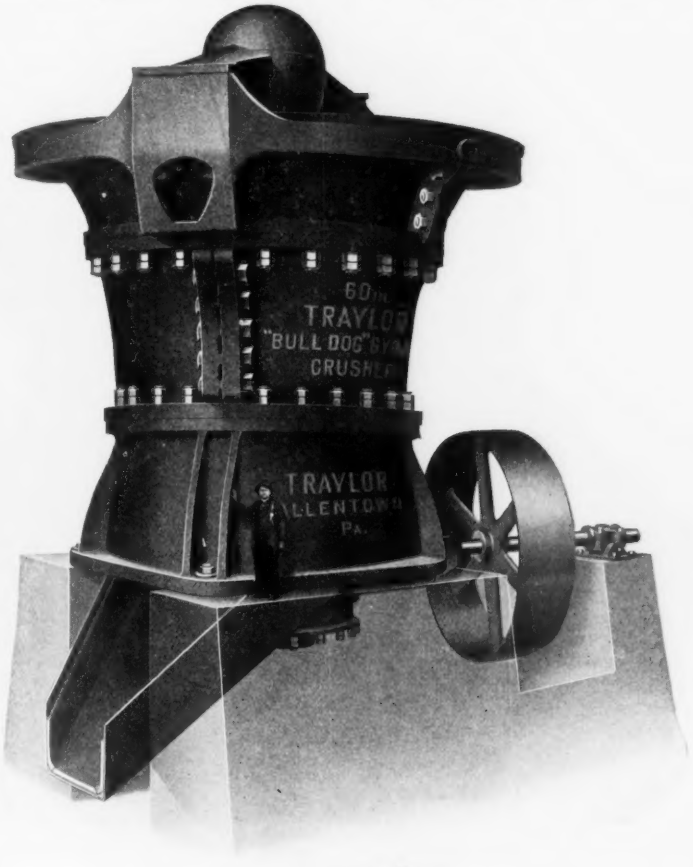
TRAYLOR

"BULLDOG" GYRATORY

Run your eye down the list shown here. There must be some good reason why many of the twenty-six have more than one Bulldog in operation. The exclusive features designed and built into every machine is the answer. If it's too much trouble to ask a user, the nearest Traylor man will give you complete information. Drop him a line today.



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Rock Cut Stone Co.
Superior Portland Cement Co.
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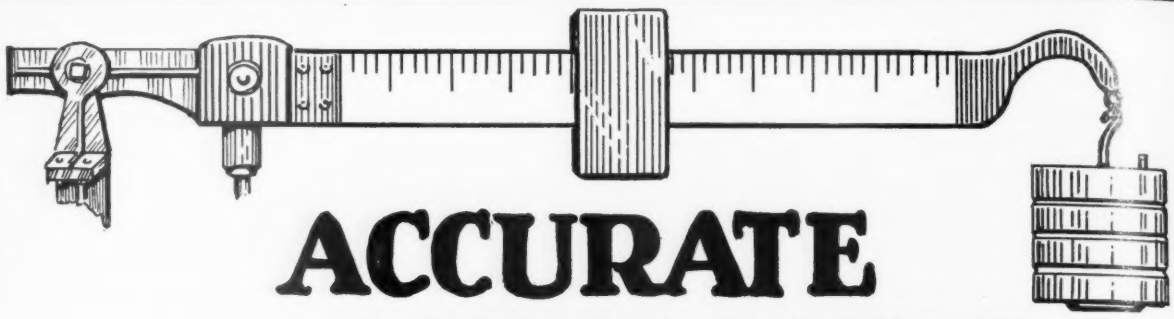
Export Department, 104 Pearl Street, New York City—Cable Address "Forsaltra"

International Machy. Co., Santiago, Chile | **W. R. Grace & Co., Lima, Peru** | **International Machy. Co., Rio de Janeiro, Brazil**



ACCURATE *and* AUTOMATIC

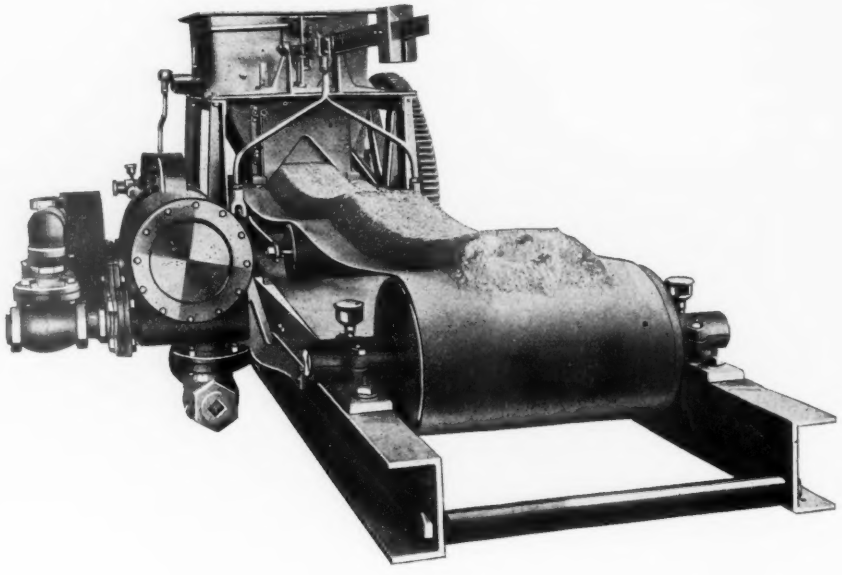
The Poidometer is accurate; in fact, we guarantee it to be 99 per cent accurate, and it will deliver bulk materials in lots of whatever weights you set.

For mixing and compounding operations, these machines, working in batteries, provide absolute accuracy and uniformity in the final product.

The Poidometer eliminates losses due to spillage and makes no mistakes.

Let us tell you how the Poidometer can save money for you.

Schaffer Engineering & Equipment Co.
2828 Smallman St., Pittsburgh, Pa.



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